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ELECTRIC MINE HOISTING.

The application of electric motors to mine hoisting, which has made considerable progress of late years in the United States and Mexico, has reached its greatest development hitherto in Germany and France, especially in the former country, and its least, among the great mining centers of the world, in Great Britain, although even here a committee recently appointed by the Royal Commission on Mines commented very favorably on the subject. There seems to be no question, in fact, that the electric mine hoist must eventually displace entirely the steam hoist which for many years has held paramount sway, and in this connection it is interesting to note that the German Government permits a maximum speed of 1,980 feet per minute for hoisting men by electricity as against a maximum of 1,188 feet per minute allowed in the case of the well-tried steam hoist.

The question of hoisting by means of electric motors is not such a simple one as might appear on the face of it. Other applications of electricity in mines, as lighting, pumping, air compressing, ventilating, etc., furnish a comparatively constant load, and hence with these the load factor is high and the application of electricity is fairly simple, the load being both desirable and profitable from an operating standpoint. The special problem in these cases is entirely one of safety from shock and from igniting the gases or coal dust present in the mines. With electric hoists, on the other hand, the load is intermittent and extremely variable, and special precautions must be taken to equalize the load, both to improve the load factor and to prevent dangerous surges on the line.

When the hoist is designed to operate on a comparatively slight grade the problem is not so difficult. In a recent example of grade hoisting, in the mine of the Washington Coal and Coke Company, at Dawson, Pa., the grade varies from 5.0 to 8.5 per cent. The hoisting drum is six feet in diameter and is driven by a 500-horsepower, direct-current, non-reversing, compound-wound motor controlled by a semi-automatic, magnetically controlled, unit-switch controller. Line surging is practically eliminated in this case by using an accelerating relay on the controller to prevent the starting switches from closing too rapidly. A safety relay is also provided which opens the resistance switches in cases of excessive overload. A further protection is afforded, as in case of the cars striking an obstruction, by a feature in the design which permits the motor automatically to be brought up to full speed again should the

relay operate when the motor is running. In this particular installation the empty cars run down the slope under gravity and are controlled in their descent by a brake on the hoist drum. The hoist is installed on the 800-foot level, and it may safely be said that it could not be operated in the existing circumstances by any other than electric power.

When the haul is a straightaway one up a vertical or nearly vertical shaft, and the loads are considerable, the problem reaches its greatest complexity, but even in this case it has been satisfactorily solved. In such cases considerable assistance is afforded by using a balanced system of hoisting, in which the weight of the rising full cars is compensated by the weight of the descending empties, so that only the dead weight of the load itself is to be overcome by the motors, in addition, of course, to the friction loads.

Among the various successful methods which have been evolved for more or less straightaway electric hoisting, one of the most promising, when alternating current is used (as is commonly the case), is the motor-generator flywheel system. This is particularly applicable for extremely heavy hoisting, and in cases where the hoist is unusually long. The first cost is admittedly high, but the resulting economy and perfect control of the system make the installation especially worth while under these circumstances.

A noteworthy example of the motor-generator flywheel system is that in the mine of the El Oro Mining and Railway Company, Ltd., in Mexico. This set consists of a 350-horsepower, alternating-current, fifty-cycle, three-phase, 3,000-volt, induction motor, and a 320-kilowatt, direct-current, 250-volt, interpole generator, with a 40,000-pound flywheel, nine feet in diameter, mounted between the two machines on the common shaft. The seventeen-kilowatt, 125-volt exciter is belted to a pulley on the main shaft of the set at the side of the flywheel.

The chief purpose in using the motor-generator flywheel set for hoisting lies in the fact that the flywheel acts as a reservoir for energy which can be drawn upon when the peak loads are encountered, especially in accelerating. In this way the motor input is equalized in a degree depending on the kinetic energy of the flywheel. The slip in the motor must, of course, be varied in amount if this flywheel energy is to be utilized just when it is required. In the El Oro mine hoist this is accomplished by an arrangement which automatically cuts in and out grid resistances connected to the motor secondary. When the power is shut off, the set will rotate over an hour before coming to rest (unless a brake be applied, which will stop the machinery in less than five minutes). This permits the hoist to be used for some little time in case the current is accidentally shut off, and it is for this reason that the exciter is driven from the set instead of separately. No repairs beyond the usual attention to the brushes, have so far been necessary in this particular installation.

The Ilgner-Halske system has been employed with considerable success in Europe, there being about sixty examples of its use in Germany alone. Many other systems might also be noted, but enough has been said to show that the problem of the electric mine hoist can be and has been solved, and that the electric hoist is meeting with increasing favor. Each particular mine, of course, usually presents a special problem, so that no one system can be regarded as universally the best. However, in view of what has already been accomplished, there seems to be no mine-hoisting problem which cannot be advantageously met by the electric motor.

IMPROVING AN OLD CENTRAL STATION.

The improvement of operating conditions in power plants of long-established design is one of the most attractive fields which can be entered by the consulting engineer. Interesting as are stations of the latest type of equipment and the most modern arrangement, it is the old plant which is always with us; the relatively out-of-date installation which is most commonly encountered in visiting commercial systems. In an art advancing as rapidly as that of applied electricity, existing plants must inevitably be constantly falling behind the standards of present-day practice; and yet many of these old stations can be maintained at good productive efficiency, all things considered, or else improved by really striking percentages in their costs of operation. The reward for a careful analysis of the service conditions in an old station often pays many times over for the expense of the investigation.

An instance of what can be done in a single year in a station of inferior design, judged by modern standards, is afforded by a 500-kilowatt plant serving a manufacturing town of about 15,000 inhabitants, and which was examined by a consulting engineer recently, in connection with a change of ownership. The plant was in poor condition generally when the investigation was begun. All the generating units were belt driven, and both sixty and 133-cycle machinery was in service. The wiring in the station was poor and intricate; the alternators of the same frequency and voltage were not connected for parallel operation under any circumstances; the engines, piping and condensers were in bad condition; the steam pressure was too low, and the load run off separate units with little regard to what the rest of the plant might be doing. On account of the low steam pressure the engines carried the steam through to the end of the piston stroke at full load. This threw too much steam upon the condensers, and in consequence the engines often operated on high back pressure. The boilers were unable to furnish enough steam under these conditions and often a part of the street lighting load of the plant had to be cut out to enable the engineer to raise the steam pressure to normal.

Outside the station the insulators were missing on many cross arms; poles were not set deep enough, and many were badly decayed. Circuits were mixed and run haphazard, with little regard to their potential and relation to other lines. Lines no longer in use in the supplying of lighting and power service to customers encumbered the poles and hazarded the safety of linemen. Primary and secondary circuits were often not separated at cross arms, and in some cases a wire as small

as No. 4 B. & S. was used in the middle of a line built with No. 0000 on each side of the former. With the system in this condition it was not surprising that the station fuel consumption per kilowatt hour delivered at the busbars was 8.2 pounds, or that the cost of operation per kilowatt-hour, exclusive of fixed charges and general expenses, was 2.88 cents. The cost of coal per ton delivered at the station was $4.88, for the year.

Following the engineer's investigation and report, the station was taken in hand, and the distribution system also put in better condition. The 133-cycle machinery was disposed of, a voltage regulator installed in the station, and tub transformers installed for the arc-lighting service in place of the direct-current belted dynamos formerly used. The station piping was rebuilt, a direct-connected alternator driven by a modern engine added, and the existing alternating-current generators wired to the switchboard so that they could be operated in parallel. This enabled the station attendants to divide the load in an efficient manner, and to forego the operation of several lightly loaded machines when one or two could carry the business. All the lines were put in safe condition and standardized for sixty-cycle service from station busbar to consumers' transformers. The steam generating plant was put in shape to handle the load without dropping out of condensing service, and the piping was almost entirely rebuilt. The installation of the voltage regulator was the means of greatly increasing the satisfaction of the public with the service, as under the old régime there were constant complaints that the lighting was inferior. The power sales were increased about one-half after the improvements.

The operating results of the station showed a remarkable gain in efficiency for the year after the changes above outlined had been effected. The coal consumption per kilowatt-hour delivered at the switchboard fell off one-third, to 5.5 pounds. The cost of coal per ton for the year was $4.98, practically the same each year, and the station labor cost per kilowatt-hour manufactured remained substantially the same, or 0.71 cent, in the second year against 0.725 cent before. The total cost at the switchboard was 2.14 cents per kilowatt-hour generated.

These figures are not cited for their absolute, but for their relative value. In this day a plant which cannot generate electricity at a lower figure than the above station, omitting all the expenses except those of mere station manufacture, does not measure very near the lines of efficiency now possible even in small central stations. When one recalls the fact that this plant had no means of measuring its generated output only four years ago and considers the point that the general design of the station has remained substantially unchanged for many years, the pecuniary value of the changes reviewed above impresses one. The saving in station cost per kilowatt-hour which was secured represents more than half its total fuel bill. In other words, the plant is better off by $525 per month than it was before the analysis of its operation was made. What has been done in the single case here cited can be done elsewhere, if managers will take a broad view of the benefits of skilled engineering advice and if power plant experts will not overlook the possibilities of improving even the more antiquated installations which are now in service.

THE MONEY VALUE OF ONE DAY'S TELEPHONE SERVICE.

A suburban telephone subscriber in the Boston district of the New England Telephone and Telegraph Company took occasion recently to determine the actual value of one day's service in connection with his business. During this day he called up eight parties from his own telephone, received five incoming calls, and called three times in the transaction of business on other lines than his own wire. The actual cost of this use of the telephone facilities of his community was twenty-eight cents, the rental of his own instrument being eight cents, and the in and out of town charges twenty cents.

Assuming that the transaction of business took the same time over the tlephone that it would have in a personal visit, and allowing one minute per call to obtain the desired party, it was found that the use of the telephone made a net saving of three-and-one-half hours, compared with the actual time it would have taken under the most favorable circumstances to make the rounds of the different parties in a well-planned trolley and steam railroad circuit. To have visited the called parties in person would have necessitated traveling twenty-five miles inside the metropolitan district, at a conservative cost of fifty cents, and this time would have been largely wasted so far as productive work went. This business man's time happened to be worth approximately $1.25 per hour, so that the actual net saving in the day's use of the telephone was $4.62. This was made up as follows: Credit to telephone, three-and-one-half hours at $1.25, and fares for twenty-five miles; total, $4.90. Debit to telephone (cost of service), $0.28. Net saving, $4.62.

The results clearly indicate that even to the man of small means the telephone is a definite money saver, and that its yearly net value to even a moderate sized community may rightly be expressed in the millions of dollars.

DEVELOPMENT OF ELECTRICAL UNDERTAKINGS.

Under this caption there appears on other pages of this issue the first part of a most interesting and instructive paper by S. J. Watson, of Bury, England, in which the author makes some excellent suggestions on electrical distribution, to which the attention of central-station men in this country is especially directed.

Among several other things noted, Mr. Watson estimates that within the radius of the Manchester (Eng.) Town Hall there are some twenty central stations having a total capacity of 100,000 kilowatts which probably cost in the neighborhood of $10,000,000. The author calculates that in this case, by interconnecting these generating stations at a cost of about $750,000, a reduction of spare plant would result, from an existing thirty-seven per cent to about twelve per cent, besides giving an increase in load of 25,000 kilowatts without any further expenditure. This is one of the best arguments in favor of centralization of electrical generation.

Prospects for the Chicago Electrical Show.

It is reported that never before in the history of Chicago's annual electrical shows has there been such an early demand for space and it is predicted that before the middle of December every available square foot of the Coliseum will have been contracted for the January show by the leading electrical concerns of America representing every branch of the industry and science. While the majority of the concerns taking space are located in Chicago, the list of exhibitors will include companies as far west as California and east as far as New York and Boston. Several of last year's exhibitors have taken larger space than heretofore and in the list of exhibitors are many who have never before been represented in the Chicago show.

The scope of the exhibits is particularly broad, the jobbers and manufacturers predominating with an unusually large percentage of electrical engineering and laboratory companies in the show. The National Electric Lamp Association, the General Electric Company, the Commonwealth Edison Company, the Simplex Electric Heating Company, the Western Electric Company, Chicago Telephone Company, the Swedish-American Telephone Company, will be among the largest exhibitors. Two electric automobile concerns are already in—the General Vehicle Company and the Baker Electric represented by Ralph Temple. The Cosmopolitan Electric Company is exhibiting for the first time and so is Macbeth-Evans Glass Company. No less than seven pneumatic cleaners have already signed for space.

Contracts made during the last week include Illinois Appliance Company, Orai and Motion Manufacturing Company, Chicago Pneumatic Tool Company, Fort Wayne Electric Works, Perfection Vacuum Cleaner Company, Acme Wire Company, Chicago Fuse Wire and Manufacturing Company, Electrical Testing Laboratories, Long Beach Electric Manufacturing Company, Cutler-Hammer Manufacturing Company, Hahl Automatic Clock Company, Schneible Company, National Carbon Company, G. L. Jackman, Henry Newgard & Company, Wonderful Pump, Milwaukee Vacuum Machinery Company, E-Z Vacuum Cleaner Company, Stolz Electrophone Company, Electro-Magnettic Tool Company, Kimble Electric Company, Sefton Manufacturing Company, United States Light and Heating Company, and Macbeth-Evans Glass Company.

The management is not ready to disclose the scheme of decoration which D. H. Burnham & Company has designed for this year's show, but it is said that in novelty, beauty and brilliancy it will surpass everything that has ever before been seen in the Coliseum. As from the general trade exhibits, there will be more unique and novel displays than ever before, making the exposition of more than ordinary interest to the thousands who attend outside of the trade.

The management is spending more money than ever on exploitation this year. It is desired to break all records in the matter of attendance. Attractive souvenirs will be offered every day. Special efforts and plans are also being made to bring into Chicago everybody in the middle west directly or indirectly interested in the allied electrical trades, particularly the central station men. Interesting electrical lectures and demonstrations are planned for every day.

The Electrical Show will open Saturday, January 15, and run until January 29, being open daily except Sundays.

President Vail on the American and Western Union Combination.

President Theodore N. Vail, of the American Telephone and Telegraph Company, to whose energetic efforts the plans for the control of the Western Union Telegraph Company by the American Telephone and Telegraph Company are due, was interviewed recently concerning the transaction. When asked if he considered the transaction amenable to the Sherman anti-trust act he said: "So far as I know there is to be no merger. We intend to live up to the law in its spirit as well as its letter, and if we thought the purchase of Western Union stock was in violation of the law we should not have made it."

Mr. Vail said that the Mackay Companies has only 80,000 of the 300,000 shares in the Bell Company and thought there was no reason for any impression that the Mackay Companies would be effective in the enlarged company.

Mr. Vail also said that the acquisition of the Western Union would mean no new financing on the part of the American Telephone and Telegraph Company. The report that Mr. Baker, one of his vice-presidents, was to succeed Colonel Clowry as president of the Western Union, was also without foundation. There will, however, be changes in the operating staff of the Western Union, and American Telephone and Telegraph men will take the place of some of the Western Union directors.

With regard to the question of telephone and telegraph poles, Mr. Vail said that the object of the acquisition of the Western Union stock was to increase efficiency which would mean cheaper service.

On being asked his opinion of the effect of the recent telephone merger on the suit just decided in favor of the Western Union Company by Special Master E. W. Burdett, President T. N. Vail of the American Telephone and Telegraph Company stated that there would probably be no immediate settlement. The suit, which is really between the Bell Company and the American Speaking Telephone Company, a subsidiary of the Western Union Telegraph Company, has been in the courts for twenty-eight years, and has been twice decided in favor of the Western Union company, and once in favor of the Bell Telephone Company. About $6,000,000 was involved, and after the decision last August the American Telephone and Telegraph Company appealed the case to the Supreme Court of the United States.

Technical Publicity Association.

At the meeting of the Technical Publicity Association held on Thursday evening, November 11, at the National Arts Club, New York city, the feature of the evening was a debate on the value of special issues of ttrade journals.

The argument was opened by James H. McGraw, president of the McGraw Publishing Company, who spoke ably for the affirmative. The matter was discussed to the contrary by Robert Frothingham, advertising manager of *Everybodys,* and in the affirmative by J. G. Frederick, managing editor of *Printers' Ink.*

In the absence of President Redfield, O. C. Harn was toastmaster. Howard M. Post, chairman of the publicity committee, reported satisfactory progress. The next meeting will be held on Thursday, December 8.

An Anti-Forgery Electric Pen.

An electric pen, calculated to prevent forgery by erasure or alteration, has recently been invented by a London (Eng.) man. This pen makes a large number of very closely spaced, almost imperceptible perforations, and the line is rendered distinct and indelible by a slight charring of the paper around each of these tiny holes.

EMPIRE STATE GAS AND ELECTRIC ASSOCIATION.

FIFTH ANNUAL MEETING AT NEW YORK

The most successful meeting which has thus far been held of the Empire State Gas and Electric Association took place on November 17 and 18 at the Engineering Societies Building, New York city. Owing to the absence of President W. T. Mohhis, R. M. Searle presided.

The first day was given over to reports of various committees and later the "Electrical Session" was held and the following papers were presented: "An Electrical Show in a Community of 45,000" by P. T. Glidden; "Electric Meter Testing" by C. G. Durfee; and "Electric Light and Power Development in New York State" by C. H. B. Chapin.

These are all live subjects, especially that on meter testing, since the smaller companies have not taken up the subject to the extent that should be the case.

Thursday morning's session was called the "gas session," and the following papers were read: "Fuel Appliances" by W. K. Eavenson; "Gas Prepayment Meter Practice" by M. H. Spear, and "Accidents" by C. D. Robinson. In the absence of Mr. Spear his paper was read by Frank Hellen. The paper on fuel appliances was excellently illustrated by slides, the author calling especial attention to the necessity of proper gas and air connections when the appliances are used under pressure.

This was followed by a most enjoyable luncheon at the Engineers' Club, at which some fifty-odd attended. After luncheon there was a general session at which the following reports were considered: Committee on accounting, committee on arrangements for sectional meetings, committee on insurance, committee on taxation. The first was of considerable importance, as the committee prepared an elaborate set of answers to questions which should greatly aid small companies in making their annual reports to the Public Service Commission.

The following officers were elected:

President, Chas. R. Huntley; Vice-presidents, M. J. Brayton and R. M. Searle.

Treasurer, G. W. Curran.

Secretary, C. H. B. Chapin.

Executive committee, Walter R. Addicks, G. W. Curran, F. L. Dame, P. T. Glidden, J. J. Humphreys, Jr., and L. C. Purdy.

Chicago Electric Club.

A subject which, during the past few years has received more or less prominence throughout the entire country, and one which is particularly interesting to residents of the state of Illinois, namely, "The Deep Waterway," was chosen as the topic of an address delivered at the regular meeting of the Chicago Electric Club on Wednesday, November 17, by W. Clyde Jones, Illinois state senator. In introducing the subject, Senator Jones told of the period of destruction which, until recent years, has prevailed. Forests, waterways and other natural resources have been destroyed and utilized with no thought given to the future, and it was not until during the past administration that any definite steps were taken to curtail these alarming conditions.

A few years ago former President Roosevelt appointed a commission charged with an investigation of conditions regarding water commerce. Since that time four annual conventions have been held, and apparently this commission has at last stirred the people into action.

According to the speaker, twenty years ago there was more commerce on the waters of this country than there is today. As the railroads developed, they did their utmost to destroy this commerce by paralleling rivers, charging only low rates along these paralleling lines and making up for the deficiencies by charging higher rates in other locations. They also purchased wharves, steamboat lines, and other institutions with the object in view of absorbing this apparent prosperity of the water transportation companies. During this time the products of the Mississippi Valley have doubled, while the transportation facilities of the railroads have increased but one-eighth.

Regarding the deep-waterway channel from the lakes to the gulf, Senator Jones said that the people of Chicago have already expended nearly sixty million dollars in constructing the drainage canal from Chicago to a few miles beyond Lockport. After completing this canal a bill was drawn up in the Illinois Legislature to the effect that the state ask Federal aid in completing the canal from its present terminal near Lockport to the Mississippi River.

Senator Jones' solution of the problem is that the state extend the present canal from near Lockport through the Desplaines River to Utica. This would require an expenditure of twenty million dollars, which has already been authorized by popular vote, but, according to the speaker, the possible waterpower that may be developed by making this extension would earn two-and-one-half million dollars yearly for the state. After this, extending the waterway to the Mississippi River would require only ten million dollars, and the securing of this amount from the government should not be difficult.

Following this address, Dr. C. P. Steinmetz, who was a guest of the club, was called upon and indorsed the points emphasized by the speaker. He said that the entire question of deep waterways and the conservation of natural resources was one of vital interest.

Bion J. Arnold added that he had learned more by listening to the address of Senator Jones than while attending the last convention of the waterway congress, of which he is a member.

American Institute of Electrical Engineers, Pittsburg Section.

The regular meeting of the Pittsburg Section of the American Institute of Electrical Engineers was held in the Carnegie Lecture Room on Tuesday evening, November 9. Papers were presented by H. N. Muller, electrical engineer of the Allegheny County Light Company on some "Applications of Concrete to Central Station System"; by F. W. Scheidenhelm, consulting construction engineer, on the "Uses of Reinforced Concrete in Railway and Power-House Work"; and by Stephen Q. Hayes, engineer with the Westinghouse Electric and Manufacturing Company, on "Concrete Construction in European Power Plants."

Mr. Muller in his paper described some reinforced concrete slab construction for switchboard work and also for the construction of semi-portable transformer houses to be placed in basements and at the rear of stores and factories.

Mr. Scheidenhelm showed a number of pictures of power-house construction and bridge construction as used by the West Penn Railways Company.

W. M. Kinney of the Universal Cement Company and B. P. Rowe of the Westinghouse Electric and Manufacturing Company discussed the papers. As the papers consumed a large part of the evening no further discussion was offered.

Long-Distance Telephony in Europe.

Recent reports from Italy state that a long-distance telephone line between that country and Germany will shortly be put into operation. The line connects Milan and Frankfort-on-the-Main, via the St. Gothard Tunnel.

New York Electrical Department News.

Commissioner J. H. O'Brien, of the Department of Water Supply, Gas and Electricity, of the City of New York, announces the establishment on December 1 of an independent office for The Bronx, to be located at the Municipal Building, 177th Street and Third Avenue. The Chief Engineer of Light and Power has ordered Inspector Francis J. Fitzpatrick with twenty-one years' experience in the department to take charge.

On and after that date all applications for permits and certificates relating to work in The Bronx will be filled at the new office, instead of at the Park Row Building, Manhattan, as formerly, and all permits and certificates for The Bronx will be issued directly from the Municipal Building in The Bronx.

Commissioner O'Brien also announces that on December 1 a working agreement with the New York Board of Fire Underwriters will go into effect. Under this agreement the commissioner will certify, and, therefore, legalize, the certificates of the New York Board for electrical equipments installed in premises involving fire risks only, such as private buildings and small stores. The New York Board certificate so certified by the department becomes legally the latter's own certificate.

It will be necessary, however, for all persons installing electrical wiring or appliances in the city to continue to file the usual application for inspection, as, in order to keep legal control of the situation, the department will decline to place its certification upon an underwriters' certificate unless the usual application for inspection shall have been filed with the Bureau of Electrical Inspection.

The territory of the New York Board of Fire Underwriters in New York city comprises the following divisions:

All of the Borough of Manhattan.

All of the Borough of The Bronx lying to the westward of the Bronx River.

So much of the Borough of Brooklyn as lies to the westward of the following line: Starting at Newtown Creek and Meeker Avenue; thence southeasterly along the borough line to Jamaica Avenue; thence southwesterly along Jamaica Avenue and New York Avenue to Montgomery Street; thence westerly along Montgomery Street to Franklin Avenue; thence southwesterly across Prospect Park to Prospect Park West and Fifteenth Street; thence southerly along Ninth Avenue to Sixty-sixth Street; thence westerly to the Narrows.

So much of the Borough of Queens as lies northwestward of the following line: Starting at Newtown Creek and Meeker Avenue and following the westerly and northerly boundaries of Calvary Cemetery to the Old Bowery Bay Road; thence northerly to Bowery Bay.

In the above designated territory—that of the New York Board—the department will not certify the underwriters' certificates for equipments in buildings owned or controlled by the city, theatres, moving-picture machine establishments, churches and other places of public assemblage where it is believed that a panic, as well as a fire hazard, may exist. In the case of these buildings the department's individual certificate will be required, as formerly.

All persons are warned against placing in service any electric wiring or appliances that have not been approved by the department, either by an independent certificate or by a certification upon a certificate issued by the New York board.

Incident to the establishment of this working agreement a joint advisory board of engineers has been constituted. This board, consisting of Messrs. Lacombe, Sever and Wynkoop, for the city, and Stewart, Forsyth and Bruen, for the New York Board of Fire Underwriters, met for organization on the evening of November 18 in the board room of the American Institute of Electrical Engineers.

The purpose of this advisory board is to consider and report on all matters relating to the electrical inspection service in the city of New York. Since these reports will be prepared in duplicate, one copy being submitted to the Commissioner of Water Supply, Gas and Electricity, and the other to the head of the New York Board of Fire Underwriters, a uniformity of rules, interpretations, approvals and inspection methods, which has not existed hitherto, may now be anticipated.

Arctic Plant Life and Auroras.

In a recent article in *Cosmos,* Professor Lemstroem, of the University of Helsingfors, Finland, adduces considerable evidence to show that the abnormal growth of vegetation in the polar regions is due to the effect of electric currents which flow between the earth and the atmosphere and produce the aurora borealis.

From a study of the concentric annual layers of growth of conifers growing in various latitudes, between the sixtieth and sixty-seventh parallels, Professor Lemstroem finds that the thickness of the annual layer varies according to a definite law, showing maxima and minima which indicate a period of ten or eleven years, coinciding with the period of sun spots and auroras.

Resuscitation After Electrocution.

Dr. Louise G. Robinovitch recently gave a demonstration before officials of the New York Edison Company of her methods of resuscitating electrocuted living beings. A rabbit, which was the subject operated on, was brought back to life by her after being electrocuted and pronounced dead by competent physicians who were in attendance.

Miss Robinovitch also gave a demonstration of the action of Leduc currents, by which anæsthesia was produced in a rabbit, without, it was claimed, the bad after-effects which are consequent on the use of chloroform, ether, etc.

In the first demonstration the current which had killed the animal was switched back into its body again, connections being made with a point over the heart and at the base of the spine. By turning on the current and then off again and by keeping up the action steadily the muscles of the heart and lungs responded to the artificial excitation. With the first tiny natural action it was necessary for Doctor Robinovitch to proceed with great care. She gave the rabbit one little chance to improve its natural efforts and then helped it along again with her machine.

Within three minutes the rabbit could breathe without artificial aid and its little heart was performing its regular functions. Half an hour after it had been pronounced dead it was hopping around the room, a little dazed, perhaps, but very much alive.

It was claimed by the demonstrator that the same methods can be applied to human beings.

The X-Ray and Diphtheria Toxin.

An account of Gerhartz's experiments on the effect of the X-ray on diphtheria toxin appears in a recent issue of the *Medical Record.* His experiments were of two series. In one he took known amounts of a toxin of known strength. From twice to six times the fatal dose for rabbits of definite size was given. In each series there were two rabbits of the same size.

To one was given the toxin unaltered, and to the other a similar amount which had been exposed for a longer or shorter time to the X-ray. In each case the toxin which had been so treated was less toxic than the untreated. In the second series the similar doses of the toxin were given at once to rabbits, one of which was exposed to the X-rays. Here, too, the rays showed a definite protective influence.

Germicide Properties of Ultra-Violet Rays.

There can be little doubt that the ultra-violet rays are the friend of man in many ways. A series of carefully conducted researches has already shown that it is the ultra-violet rays in sunlight which are responsible for the production of ozone in the air, and the presence of ozone is an unmistakable sign that there is a complete absence of organic impurity. In great industrial centers where a pure air is needed most, the murkiness of the atmosphere acts as an effectual barrier against the rays, and therefore their beneficent work is largely hindered. The plea for the ultra-violet rays is therefore merely the plea for sunshine itself.

Later investigations have shown that the ultra-violet rays have an interesting action upon water, resolving part of it into hydrogen gas and peroxide of hydrogen. It has for long been maintained by some observers that the freshness of air, particularly after a welcome or long-delayed shower of rain, is due to peroxide of hydrogen, which readily oxidizes organic matters or impurities with which it may come into contact. The presence of peroxide of hydrogen in the immediate proximity of waterfalls has also been suspected.

Further, the ultra-violet rays are inimical to disease organisms. Whether this destructive action is due directly to the rays or to the oxidizing products which they effect is a matter which has not received a definite answer.

Among the best artificial sources of ultra-violet rays is the quartz mercury lamp. This, when immersed in clear water affected with ordinary microbes and the coli bacillus, destroys those organisms within the radius of a foot in a minute. It is also a curious fact that the ultra-violet rays have been found to check fermentations.

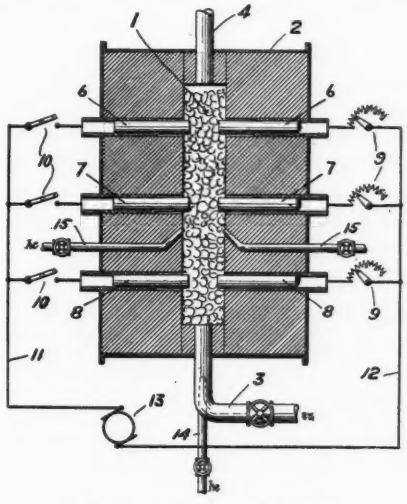
Lastly, it is probable that ultra-violet rays are largely concerned in the great assimilative processes of plant life. It has been found, for example, that the assimilation of carbon by the leaves of wheat takes place about five times more rapidly when the sky is clear—that is, when ultra-violet rays obtain—than when it is cloudy. Altogether, the evidence of experiment is in favor of the conclusion that the ultra-violet rays fulfill a role of benefit to the human race, and the further study of their nature and action will be watched with interest.—*Abstracted from the Lancet (London, Eng.), October 16, 1909.*

Electrically Manufactured Water Gas.

That there is never a lack of methods for gas enthusiasts to get around the use of the more convenient electric light is shown by a recent patent for a process of making water gas by electricity.

In this method the patentee, Charles E. White, of Philadelphia, proposes to heat up a conducting, refractory material by the passage of an electric current, and then to pass steam and the necessary hydrocarbons through the heated mass.

The accompanying diagram shows a cross-section of the furnace as well as the electrical connections. The refractory material is contained in a chamber, 1, and is surrounded by a non-conducting sheath, 2. Current from the generator 13 enters through switches and rheostats to the conducting tubes 6, 7 and 8. Steam enters through the pipe 3, and



ELECTRIC GAS-GENERATOR.

hydrocarbons are forced in through pipes 14 or 15. Water gas, with the proper mixture of hydrocarbons, issues from pipe 4.

Considerable advantage is claimed to result from the constant heat, and the ability to heat the steam and the hydrocarbons independently. The inventor does not state, however, whether this advantage will be great enough to offset the greater cost of the gas, nor does he state in what way the "electrified" gas will produce a better illuminant than the direct use of electricity for lighting purposes.

Civil-Service Examinations for Engineer and Draftsman.

The United States Civil Service Commission announces an examination on December 15, 1909, to fill two vacancies in the position of assistant engineer at $1,080 per annum each, National Museum, Smithsonian Institution, and vacancies requiring similar qualifications as they may occur.

The examination will consist of the subjects mentioned below, weighted as indicated:

SUBJECTS.	Weights.
1. Letter-writing (a letter of not less than 150 words on some mechanical and electrical engineering subject. Competitors may select either of two subjects given)	10
2. Practical questions in mechanical and electrical engineering (comprising the construction and operation of the heating plant and electric lighting and elevator machinery in first-class public buildings)	65
3. Experience in mechanical and electrical engineering work	25
Total	100

Age limit, twenty years or over on the date of the examination.

Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to any local secretary of the board of examiners, for application Form 1093. In applying for this examination the exact title as given at the head of this announcement should be used in the application. An early application is necessary to permit of time for shipment of examination papers.

The United States Civil Service Commission announces an examination on December 14 and 15, 1909, to secure eligibles from which to make certification to fill a vacancy in the position of mechanical draftsman, $1,500 per annum, Engineer Department at Large, Portland, Ore., and similar vacancies as they may occur.

The examination will consist of the following subjects, weighted as indicated: (1) Machine design, thirty per cent; (2) shop work, ten per cent; (3) drawing, thirty per cent; (4) training and experience (rated on application), thirty per cent. Two days will be required for this examination. The subject of drawing will be given on the second day, and in connection with this subject the use of handbooks of mechanical engineering formulas will be permitted.

The appointee will be expected to design the details of simple but heavy machinery and castings; should be familiar with machine shop, foundry, and forge work; should have had some experience in the drafting department of a machine shop; should be able to determine the dimensions of machine parts when the conditions are given, and calculate the stresses and weights. Experience and qualifications along these lines must be indicated in the application.

Applicants should at once apply to the United States Civil Service Commission, Washington, D. C., for Form 1312.

Improving Commercial Conditions at Home and Abroad.

The increased commercial activity which has characterized conditions in the United States during the past few months is beginning to make itself apparent in other parts of the world. The records of the Bureau of Statistics of the Department of Commerce and Labor, which have during the past several months indicated a marked improvement in both the internal and foreign commerce of the United States, are now showing improved conditions in the foreign commerce of many of the countries of the world.

Argentina's imports in the six months ending with June, 1909, show a gain of $9,000,000 over the same months of last year; exports a gain of $28,000,000. Australia, while showing a slight decline in imports, shows an increase of $7,000,000 in exports in the first six months of 1909 over the corresponding period of 1908. Austria-Hungary for the seven months ending with July last shows an increase of $18,000,000 in imports and $2,000,000 in exports. Belgium for the eight months ending with August shows a gain of $34,000,000 in imports and $14,000,000 in exports. Brazilian imports for the six months ending with June, 1909, show a drop of $8,000,000, but the exports meantime show an increase of $23,000,000. British South Africa shows for the eight months ending with August, 1909, a gain of $6,000,000 in imports and $11,000,000 in exports. Canada's imports for the five months ending with August, 1909, are $142,000,000, against $112,000,000 in the corresponding months of last year; and her exports, $97,000,000, against $90,000,000 in the same months of last year. Cuba for the twelve months ending June 30, 1909, shows imports $84,000,000, against $97,000,000 in the preceding fiscal year; and the exports, $116,000,000, against $97,000,000 last year. Egypt shows, for the eight months ending with August, 1909, a decline of $9,000,000 in imports, but an increase of $6,000,000 in exports. France for the eight months ending with August, 1909, shows an increase of $40,000,000 in imports and of $48,000,000 in exports. Germany shows, for the six months ending with June, 1909, an increase of $47,000,000 in imports and of nearly $3,000,000 in exports. British India for the four months ending with July, 1909, shows a decrease of $20,000,000 in imports, but an increase of $30,000,000 in exports. Italy shows for the eight months ending with August, 1909, an increase of $29,000,000 in imports and of $12,000,000 in exports. Japan for the seven months ending with July, 1909, shows a decrease of $21,000,000 in imports, but an increase of $5,000,000 in exports. Russia in Europe for the six months ending with June, 1909, shows a decline of $1,250,000 in imports, but an increase of $75,000,000 in exports. Switzerland for the six months ending with June, 1909, shows an increase of $5,000,000 in imports and of $4,000,000 in exports. The United Kingdom shows for the nine months ending with September, 1909, imports, $2,189,000,000, against $2,121,000,000 in the same months of 1908; and exports, $1,350,000,000, against $1,390,000,000 in the corresponding period of last year—an increase in imports but a decline in exports. Imports into the United States in ten months ending with October, 1909, the latest period for which figures are available, amounted to $1,195,000,000, against $900,000,000 in the same months of the preceding year; and exports, $1,360,000,000, against $1,403,000,000 in the corresponding months of the preceding year; while for the single month of October the figures are, imports, $127,000,000, against $102,000,000 in October of last year; and of exports, $199,000,000, against $172,000,000 in the same month of 1908.

These increases in foreign commerce both in the case of the United States and of other countries, while indicating in some degree an increase in quantity of merchandise moved, are in part due to higher prices. Just as lower prices in many articles immediately followed the commercial depression of 1907-8, an advance in prices has, in many cases, followed the improved conditions of 1909.

Copper Consolidation Certain.

Further conferences between the Amalgamated Copper, Cole-Ryan and Guggenheim interests were held recently for the purpose of discussing plans for consolidation of the copper properties of the above-named interests. The statement was made on good authority that negotiations had progressed to a point warranting the assertion that the merger would be brought about before the close of the year.

There will probably be an issue of preferred and common stock, the preferred to be a six per cent stock on a basis of profits from thirteen-cent copper. There would then be available six per cent dividends on the common stock on a basis of sixteen-cent copper. However, it is understood that no agreement has been reached in the matter of capitalization.

Transformer for 500,000 Volts.

The Allgemeine Elektrizitaets-Gesellschaft has built, for testing purposes, a transformer having a capacity of fifty kilowatts, at 500,000 volts and fifty cycles, regarding which the following data are given: The transformer is of the core type with concentric windings. The low-tension part has two coils for 1,040 volts, each wound directly on the legs. The high-tension winding, with twenty-eight coils for each leg, is separated from the primary by a number of insulating cylinders. Each high-tension coil has 377 turns, and develops about 9,000 volts; that is, nearly twenty-four volts per turn. Accordingly as the low-tension coils are connected in series or parallel, the ratio of transformation is 1,040 to 500,000 or 2,080 to 500,000 volts. The high-tension terminals had to be constructed with special care. They are made of wood and cardboard, pass through oil directly to the high-tension coils, and extend about two metres above the oil case, their entire length being 2.6 metres. The floor space covered by the transformer measures 1.9 by 2.4 metres, and the oil required is 8,000 kilogrammes. The total weight of the transformer, including oil, is 13,000 kilogrammes. At 500,000 volts the spark discharge takes place between needle points at a distance of 1.3 metres.—*Abstracted from Elektrotechnische Zeitschrift (Berlin), October 14.*

Dehydration of Transformer Oil.

The relatively new process for removing moisture from oil to be employed for insulating transformers consists in bringing the oil in contact with sodium. This metal reacts on the water, forming hydrogen, which liberates itself, and soda, which drops to the bottom of the oil vessel. Sodium is added to the oil gradually in small quantities, at the rate of about twenty-five grammes to 100 litres, until a further addition no longer causes any formation of hydrogen. The quantity of sodium necessary naturally depends on the degree of humidity contained in the oil, but 500 grammes of sodium for 100 litres of oil are usually more than sufficient. The oil should be stirred several times a day for one minute at a time, and after several days it may be used. The process may also be applied to oil contained in transformer cases in service. In this case the sodium is cast in small bars, attached to iron wires, and immersed in the oil.—*Abstracted from L'Industrie Electrique (Paris), September 30.*

THE BOSTON ELECTRICAL SHOW.

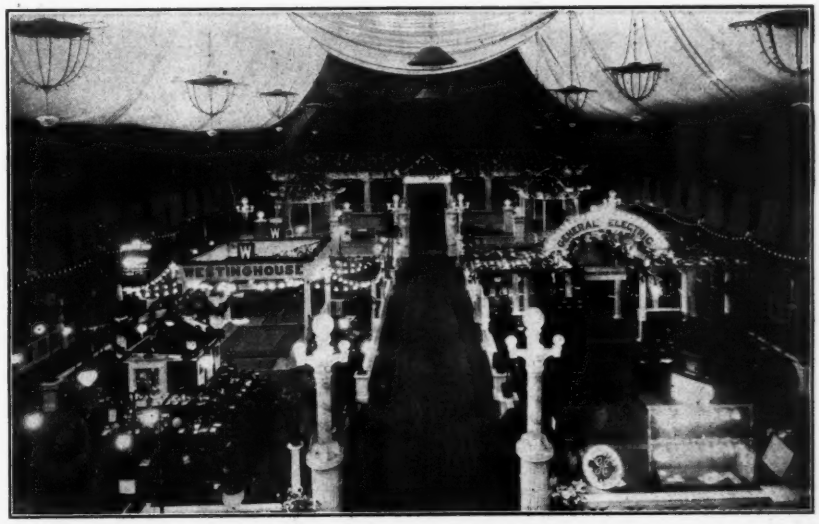
SUMMARY OF THE EXHIBITS AT THE FIRST GREAT ELECTRICAL EXHIBITION IN NEW ENGLAND.

From the great crowds that flocked to the Mechanics Building in Boston daily from November 15 to 25, and from the satisfactory reports of the exhibitors, it is evident that the first Boston Electrical Show more than fulfilled its mission of educating the public in and around "The Hub" to the numerous advantages of electricity in its many applications for industrial, domestic and public purposes. Every feature of the exhibition was planned with much care and executed in an admirable manner. Great credit is due to the management for the excellence of the arrangements and to the Edison Electric Illuminating Company of Boston, and the Boston Elevated Railroad Company for aiding materially in the success of the show.

The general scheme of illumination and decoration and the leading features of the exposition were described in these columns in the last issue. At the risk of reiteration it may be advisable to mention a few of the more striking features. The illumination of Huntington Avenue from Copley Square to Massachusetts Avenue with a multitude of flaming arc lamps produced not only a most spectacular "Great Yellow Way" leading to the show from both directions but proved an effective demonstration of the most modern ideas in street lighting. Within the exposition building, and even on its roof there was also a blaze of light. A popular and very valuable feature proved to be the series of lectures given by E. L. Ovington on some of the more mysterious electrical phenomena, such as those associated with wireless and high frequency tests. L. D. Gibbs, Day Baker and L. Bishop lectured on the utilitarian value of electric lighting, electric power, electric heating, and electric vehicles and did much to make the use of electricity still more popular.

Among the exhibits the largest and most striking was that of the Edison Electric Illuminating Company of Boston, which had possession of the stage and the floor directly in front of it and had converted all this space into a beautiful replica of an Italian garden. Not only were the scenery and lighting effects in harmony with this scheme, but even the attendants were attired in bright Italian costumes. The company supplies current to thirty-eight communities and suburban sections about Boston, and each of these was represented by a charming maiden, who distributed literature relative to the particular section and descriptive of the Edison service available and also registered the names of visitors from the respective section. Each registry counted as a vote and every day the company made a present to some charity in the town whose fair representative had secured the most votes on the preceding day. A pleasing feature of the exhibit was the periodical appearance of a group of minstrels who discoursed sweet music, both vocally and on their mandolins. During these intervals the lights were dimmed and a moon was made to rise on the painted scene at the rear. On the whole the general arrangement of the entire exhibit was so effective that every spectator was most favorably impressed.

The Boston Elevated Railway Company had a very interesting display of signals and safety devices for safeguarding its passengers. A working model of its electro-pneumatic block semaphore system was shown in connection with a miniature electric railway. There was also exhibited an electro-pneumatic interlocking switch system. The reliability of action and perfection of control of these devices was clearly demonstrated to the public and explained in detail by the company's numerous representatives.



GENERAL VIEW OF THE FIRST BOSTON ELECTRICAL SHOW.

The Simplex Electric Heating Company occupied a prominent booth on the main floor jointly with the Simplex Electrical Company. The latter company showed a line of its well-known wires and cables; Wm. S. Davis was in charge of this exhibit. The Simplex Electric Heating Company had a very complete line of its numerous heating appliances, including toasters, percolators, heating pads, ovens, water heaters, radiators, ranges, chafing dishes, flatirons, etc. The use of these appliances was demonstrated, and this attracted considerable attention. Representing the company were Frank Stone, Roger Ingalls and Charles Emerson.

The Campbell Electric Company, of Lynn, Mass., represented by L. E. Gott, showed a complete line of portable X-ray and high-frequency apparatus. There were also shown sets of X-ray tubes and electrodes of all descriptions for medical purposes, eight-day-time switches, bell-ringing and other low-voltage transformers particularly for low-voltage tungsten lamps, as well as the Thermo flashers for use with electric signs.

The Gray National Telautograph Company showed in operation one of its instruments in the booth of the Stuart-Howland Company. Chas. O. Crawford, the New England manager of the company, was present and explained the operation of the instrument.

The Franklin A. Snow Company, of Boston, and the H. B. Camp Company, of New York, jointly occupied the booth in which was shown a section of a manhole in which Camp conduits were used. A large number of samples of both straight and curved duct of Camp manufacture were also shown.

The Diehl Manufacturing Company, of Elizabethport, N. J., made a display of its line of slow-speed motors, the new type "G" motor, a number of small motors, and a working demonstration of its individual sewing-machine motor for both alternating and direct-current circuits. There were also shown oscillating and swivel trunnion fan motors and a motor-driven coffee mill. Wm. P. Miner, of the Boston office, was in charge.

The Allis-Chalmers Company, of Milwaukee, was one of the largest exhibitors at the show. Four booths near the main entrance were occupied. These were tastefully decorated with bay trees, palms, boxwood and other shrubberies, as well as a multitude of chrysanthemums. Facilities were afforded the company's guests to rest while listening to the music. The exhibit consisted of direct and alternating-current motors of various sizes and types, centrifugal pumps, portable air compressors, lighting and power transformers, clutch pulleys, and other mechanical transmission devices, and two large swinging racks containing photographs of the various products of the company, and numerous views in its several works. The company was represented by Messrs. Pardee, Merrill, Pestell, Vrabek, Ober and Watson, of the Boston office, and F. G. Bolles, commercial engineer of the Milwaukee office, who was in charge of the exhibit.

The Blake Signal and Manufacturing Company had an exhibit of its signaling devices on the main floor.

The Dow Surgical Battery Company, of Boston, devoted its space to an exhibit of electrical vibrators and Arnold electric cleaners.

The ELECTRICAL REVIEW AND WESTERN ELECTRICIAN occupied a booth on the main floor, where copies of the current issues were distributed and electrical men cordially welcomed.

The Hurley Machine Company, of Chicago, had a number of its Thor motor-driven washing machines in operation. Its booth was in charge of N. Herbert Haberle, of the New York office. The Thor

washing machine was also shown in the "electrical house" in the basement exhibit.

The Ley Construction Company, of Springfield, Mass., showed a number of photographs of electrical installations made by the company.

The "1900" Washer Company, of Binghamton, N. Y., exhibited an electric washer and wringer, whose merits were explained by A. S. Terry, of the Boston office.

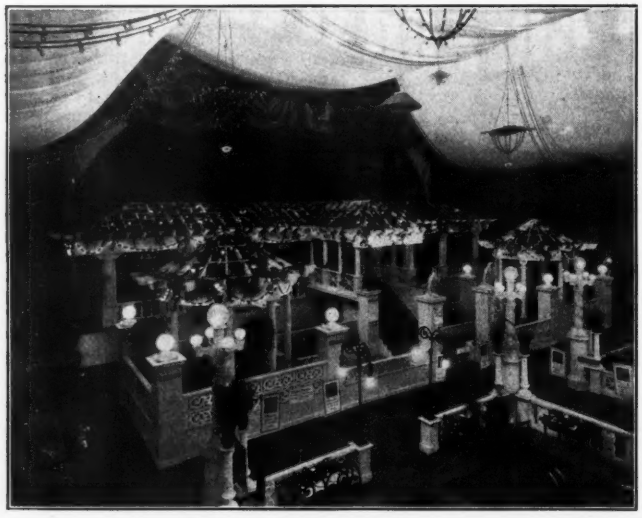
The Stackpole Battery Company, of St. Marys, Pa., occupied a space on the main floor and was represented by Harry E. Stover and Oliver Turgeon.

The Perfection Dish Washer Company, Portland, Me., made an exhibit of the Perfection and Yankee dish washers. G. M. Cram was in charge of this exhibit.

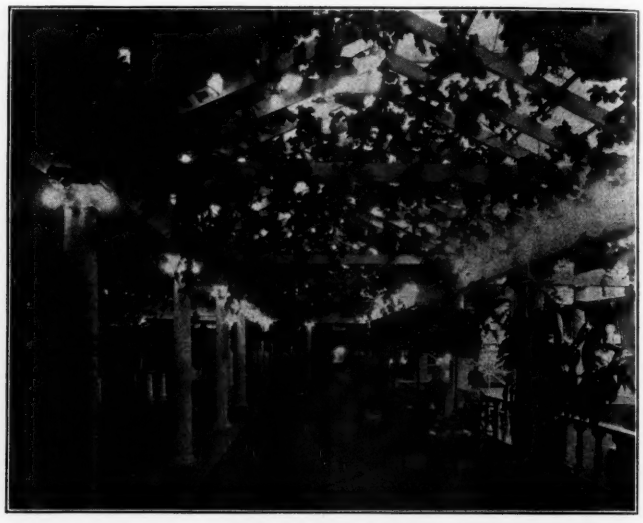
The Shelton Electric Company showed a set of its vibrators and electric hair-drying machines.

The Duntley Manufacturing Company showed a number of its electric vacuum cleaners in operation in its attractively decorated booth.

Wm. J. Murdock & Company, of Chelsea, Mass., exhibited apparatus for wireless telephony and telegraphy.



General View of the Booth.



In the Interior of the Booth.

EXHIBIT OF THE EDISON ELECTRIC ILLUMINATING COMPANY OF BOSTON.

Duren & Kendall, the New England agents for the Santo vacuum cleaner, made a demonstration of this appliance.

The Electric Cleaner Company, of Chicago, through its sales manager, John M. Rodger, made a display of its electric vacuum cleaners.

The New York Electrical School distributed literature descriptive of its courses and showed a number of photographs of work done at the school. John L. O'Connor, secretary and treasurer, was in charge of the booth.

The Poole Printing Company and the Whitlock Printing Press Manufacturing Company, of Boston, Mass., showed in operation a number of motor-driven printing presses, linotype machines and paper cutters.

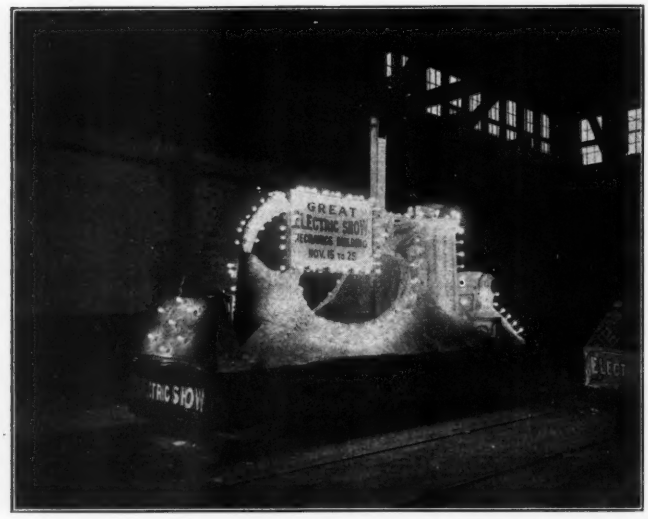
The Westchester Appliance Company, of New York, showed a line of Diamond dry batteries. J. H. Cooper and L. W. Wales, Jr., were in attendance at this exhibit.

The J. H. Day Company, of Cincinnati, showed in its space a motor-driven dough mixer, as used on all United States battleships; also a motor-driven ink mill, egg beater, egg and cake mixer and rubber cement mixer. G. H. Petrie was in charge of the exhibit and assisted by E. A. Johnson.

The Boston Electrical Contractors' Association made an attractive display of electrical decorations, fixtures and various appliances. The exhibit drew considerable attention.

The Rae Electric Vehicle Company, of Boston, exhibited one of its cars that had been run over average roads for a distance of some 15,000 miles and was in excellent condition.

The Radio Reflector Company, of New York city, showed a board on which were mounted lamps of various candlepowers, some with Radio reflectors and some without, thus demonstrating the increased light possible through their use. S. S. Adams was in charge.



ONE OF THE ELECTRICAL FLOATS THAT ADVERTISED THE BOSTON SHOW.

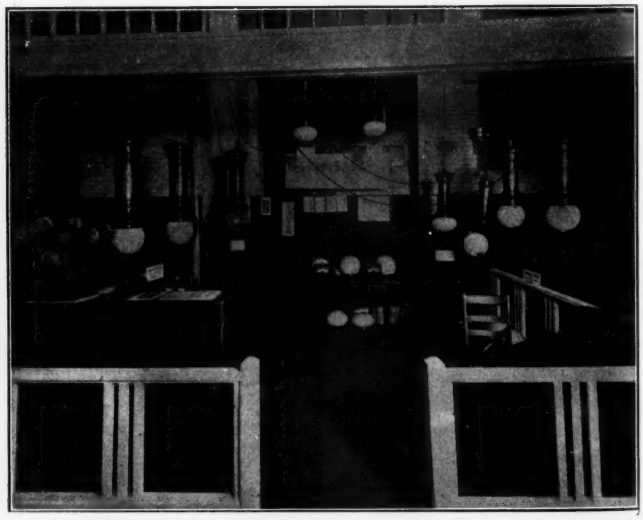


EXHIBIT OF THE AMERICAN FLAMING ARC LAMP COMPANY.

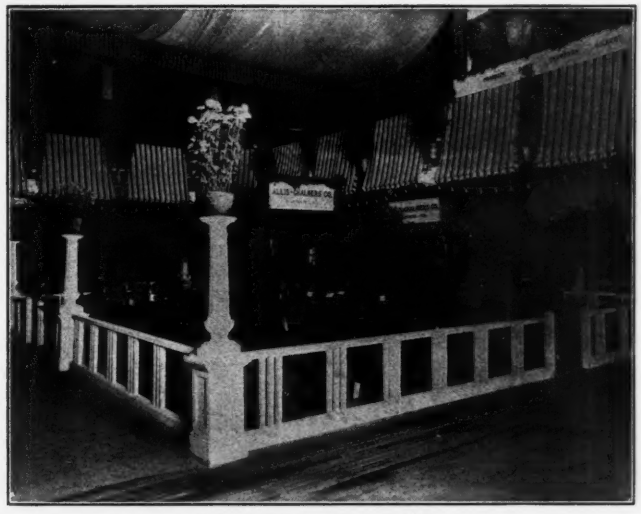
The Electric Storage Battery Company, of Philadelphia, showed a cell of type H-77 Exide battery, this being a sample of a 25,000-ampere "stand-by" battery recently installed at the Atlantic Avenue station of the Boston Edison Company; nine standard sets of electric vehicle batteries; Exide sparking batteries; car-lighting batteries; automobile electric headlights operated by Exide sparking

batteries; a duplicate of the Chloride Accumulator used for wireless telegraphy by Jack Binns on the steamship "Republic;" a nickel-plated model of one of the first Holland submarine torpedo boats. A larger model of the more modern Holland torpedo boat was exhibited in another part of the hall, this being ten-and-one-half feet long. To give an idea of the enormous Exide batteries carried by all these torpedo boats, one of the large, heavy shell rubber jars used was on exhibition. F. J. Stone, manager of the Boston office, L. C. Kerrick and T. P. Belford represented the company.

The New York Pole Company, of which G. M. Gest is general manager, had on view a full line of cages such as it uses all over the United States and Canada in reinforcing tubular trolley poles. H. H. Stannard, commercial engineer, was in charge of the exhibit.

The Albert and J. M. Anderson Manufacturing Company, of Boston, showed a line of "Anderson" time switches, a 4,000-ampere remote-control switch, electrical line material and also a general line of switches. Alf. E. Anderson, George Crane and Andreas Anderson represented the company.

GENERAL ELECTRIC COMPANY.



ALLIS-CHALMERS COMPANY.

The Dearborn Drug and Chemical Company, of Chicago, occupied a booth in charge of P. H. Hogan, its New England agent.

S. R. Bailey & Co., of Amesbury, Mass., showed a Bailey electric victoria equipped with the new Edison battery. Edwin W. M. Bailey had charge of this exhibit.

The Baker vacuum cleaner was exhibited by R. C. Baker, of Boston.

C. S. Knowles, of Boston, displayed a complete line of electrical supplies in his booth on the basement floor.

Three "Detroit" electric vehicles comprised the exhibit of the Boston Garage Company.

The Dodge Motor Vehicle Company, of Indianapolis, Ind., had on exhibition one of its $2,000 coupès and a $1,600 Stanhope. H. Ware Lincoln, of the electrical department of the Boston office, had charge of this exhibit.

The Massachusetts Fan Company showed an exhaust fan driven by a C. & C. motor.

The General Electric Company's booth, as shown in the illustrations, was a very attractive one. From the pergola there were suspended 120 tungsten lamps partly covered by vines. The exhibit included displays of the latest developments in heating apparatus and lamps. Attractive designs of copper and silver tea kettles and coffee percolators elicited much comment, as did a new line of soldering irons embodying the spiral wire handle and removable tips in soldering tools. Other new heating devices exhibited were the solder-melting pot, sealing-wax heater, automatic flatiron, "cast in" unit frying pan and tea kettle and foot warmer. There was also shown a line of flaming arc lamps, intensified arc lamps and a multiple automatic cut-out hanger with rope suspension. A feature worthy of mention was a motor-driven braiding machine in operation, showing the method of making cord for General Electric heating devices. In the center of the booth were motors operating Ingersoll-Rand drills and the Bridgeport Safety Wheel Company's grinder. A line of small motors not in operation permitted close inspection. A large assortment of fan motors, rheostats, compensator panels, circuit-breakers, meters and instruments, a multiple rectifier, a 10,000-volt lightning arrester and a display of automobile accessories completed the exhibit. Those present of the company's representatives included C. B. Davis, J. P. Felton, E. G. Brokaw, G. E. Hunter, S. W. McCollum, O. F. Brastow, G. F. Steele, A. C. Kilgour, W. G. Wragg, J. A. Wilson, H. J. Moore, L. C. Lloyd, from the Boston office, F. W. Willcox, of the Harrison Works, and F. H. Gale and J. R. Lovejoy, from the general office, Schenectady. The exhibit was installed by D. W. Shugg, of Schenectady.

In the booth of the Stuart-Howland Company, of Boston, were exhibited the following specialties: Excello flaming arc lamps, Voltmer daylight lamps, Sterling incandescent lamps, Pacific Heating Company's appliances, Hartford lime switches, Crouse-Hinds condulets, Couch & Seeley telephones, and Holophane reflectors, besides a number of fixtures, table lamps, etc. The company was represented by A. E. Payne, George Wahn, J. B. Bailey, H. McKay and others of its force.

The Bay State Electric Company, of Boston, showed an artistically arranged dining-room table decorated with electrically lighted flowers and fruits. C. A. Rounds, manager, was in charge.

The Edison Manufacturing Company and Edison Phonograph Company exhibited a number of phonographs. In attendance were John Pelzer and M. J. Reid.

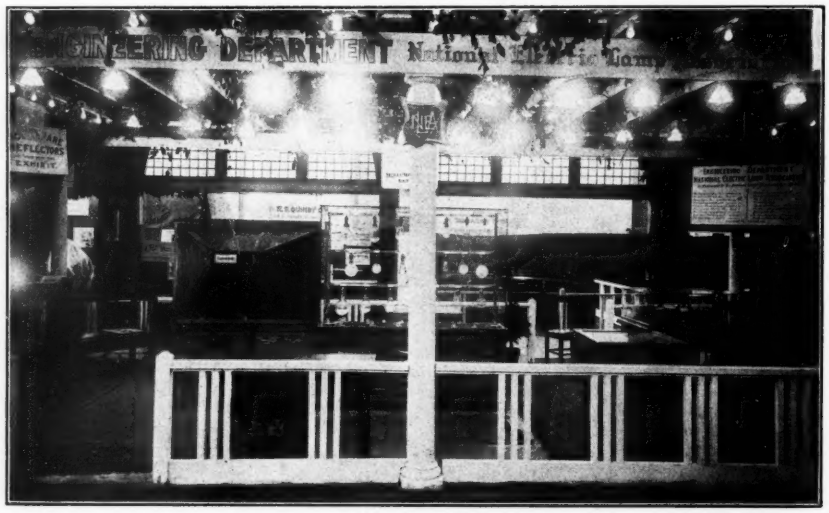
S. B. Condit, Jr., & Co., of Boston, showed a full line of its noted specialties, including the Orangeburg fibre products. A large pyramid of Sterling flexible metallic conduit was located at one corner of the booth, and similar pyramid of Alphaduct at the opposite corner. An assortment of Condit pipe caps, steel and galvanized conduit fittings and boxes, set screw box connectors, Condit-Marlin cable hangers, etc., were displayed. The exhibit was in charge of Geo. S. Dow.

In the Westinghouse Electric and Manufacturing Company's exhibit was shown a very complete assortment of the smaller pieces of apparatus which it manufactures. The booth was divided into three sections. In the first section were exhibited several sizes of its small DA and DZ power motors, its type S, type CCL and textile motors, together with control devices for controlling the different motors; a very complete line of portable and switchboard instruments, as well as economy coils, tailors' irons, buffing motors, fan motors, rectifiers, and other detail apparatus in general. Several motor applications were in operation. These were placed around the outside of this part of the exhibit, while a large pyramid was built in the center, on which the various pieces of apparatus were mounted which were not operated. Hanging from four cross-arms, which were supported from the center of the pyramid, were several types of Nernst lamps; mounted on the Nernst lamps were four oscillating fan motors with Westinghouse pennants, and with the stop plugs removed, allowing the oscillating fan motors to make a complete circle. In the rear of the exhibit was shown a complete line of motor-driven household devices, as well as electric flatirons, toaster stoves and sewing-machine motors. The company had demonstrators in this part of the exhibit, and for the first time there was given a public demonstration of popping corn on the Westinghouse toaster stove, a new application which has been added to the already many applications which this little toaster or cooking apparatus has. In the center of this part of the exhibit were operated several types of washing machines and vacuum cleaners. The company also had a very complete display of tungsten lamps. At the side of each entrance was a large iron column, which supported two goose-necks, from which was suspended a seventy-five watt and a 100-watt tungsten series lamp with Holophane reflectors. Over each of the reception rooms were festoons of twenty-five-watt low-voltage tungsten lamps; while over the main passageway was a line of various sizes of tungsten lamps for both 110 and 220 volts, ranging in sizes from the twenty-five-watt to the 250-watt lamps. Among those attending at the exhibit was G. M. Bates,

manager of the company's Boston office, together with the following from his office: C. P. Wahn, I. P. Sprague, M. B. Chase, S. S. Bell, D. A. Crowell, W. Noyes, S. St. J. Morgan, E. C. Morse, G. S. Gibbs and E. C. Baugher.

The American Flaming Arc Lamp Company, of Boston, had on exhibition ten of its flaming arcs. Novelties to electrical visitors were its multiple alternating-current lamp, burning with nine to ten amperes and seventy-two volts at the arc, and its multiple direct-current lamp with five-and-one-half, seven-and-one-half and ten amperes, and seventy-five to eighty volts at the arc. C. D. Lanning, president; J. D. Robinson, manager and treasurer, and Malcolm H. Baker were in attendance at this booth.

The booth of the Engineering Department of the National Electric Lamp Association was prominently located and attractively decorated in harmony with the general decorative scheme of the show. On the beams composing the roof were placed tungsten sign lamps and rows of the regular 110-volt tungsten lamps equipped with Holophane glassware. The exhibit consisted in general of all regular



NATIONAL ELECTRIC LAMP ASSOCIATION.

types of tungsten, tantalum and Gem 110-volt lamps, tungsten sign, miniature and street series lamps and tungsten multiple lamps burning at various angles. A large case, composed of two similar compartments, each containing men's furnishing goods of identically the same patterns and colors, was lighted respectively by carbon and tungsten lamps to show their relative color value. In another case were displayed the important steps in the manufacture of the carbon lamp, from the cellulose to the finished lamp. Still another interesting feature was the exhibit of tungsten ores and oxides, pure tungsten, the filament as squirted and finally the filament ready for mounting. The exhibit of carbon lamps made in the early sixties by Henry Goebel attracted much attention. Among those in attendance at this exhibit were P. F. Bander, A. C. Andrews and C. O. Brandel.

A. F. Neale, of Boston, showed a Baker electric coupé and a victoria.

The Invincible electric renovator was shown in the booth of the Electric Renovator Manufacturing Company, of Pittsburg.

An exhibit that proved to be a source of attraction was that of the Electric Testing Laboratories, of New York city. Among other features, a color booth, illustrating the color effect of different electrical illuminants on the same fabrics was shown. N. B. Thompson was in charge of this display.

The Godfrey Specialty Company, of Boston, exhibited the Polar flaming arc and the Sunray arc lamps. E. N. Godfrey was in charge.

Columbia electric vehicles were exhibited by J. H. MacAlman, of Boston.

The Studebaker Brothers Company, of New York, through its Boston branch, exhibited one of the 1,500-pound electric wagons for light delivery work, and one of the new landaulets. Herbert L. Converse represented the company.

G. M. Gest, the well-known conduit engineer and contractor, of 277 Broadway, New York city, made an exhibit of a manhole nearly finished and showing his method of construction as applied to underground work. Cables of all sizes were drawn into the manhole and a fine example of cable splicing was shown. Gest's patent cable rack and hangers were also built into the manhole.

The Clapp-Eastham Company, of Boston, showed an interesting exhibit of wireless telegraph apparatus for private installation, X-ray outfits, etc. A feature of this exhibit was one of Prof. Elihu Thomson's multiphase motors. In charge of this exhibit were M. Eastham and O. K. Luscomb.

The National-Acme Manufacturing Company, of Cleveland, had on exhibition a motor-driven automatic screw machine in operation; various examples of the work turned out by the machine were also shown. M. M. Brunner, John F. Judd and Oliver Henn were in attendance.

The Holtzer-Cabot Electric Company, of Boston, in its booth near the main entrance showed a large line of its telephones, annunciators, alternating-current and direct-current motors from one-twelfth to fifteen horsepower, gas-engine igniters, auto horns, wireless operators, head receiver, etc. A novelty show was a "fool proof" apartment-house vestibule telephone and letter box. Motors for grinding and drilling were displayed in operation. C. W. Holtzer, T. W. Ness, A. P. Waterman and Messrs. McElroy, Archie and Balcomb were in attendance.

The booth of the Condit Electrical Manufacturing Company, of Boston, was located near the main entrance and contained many new and interesting features, the most important of which were the remote-controlled electrically-operated oil switch and the Burnham voltage regulator. A full line of carbon-break direct-current circuit-breakers, together with various types of oil switches, were mounted for operation on switchboard panels. Among other pieces of apparatus were exhibited pole line switches, engine-governor control switches, disconnecting switches, testing clips, etc. A complete line of Shawmut specialties were shown. The company was represented by S. B. Condit, Jr., C. C. Badeau, G. A. Burnham, A. E. Green and F. D. Masterson.

Annual Meeting of the American Society of Mechanical Engineers.

The thirtieth annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 West Thirty-ninth Street, New York, December 7 to 10 next.

The entire social entertainment will be in charge of the members resident in and about New York, under the immediate direction of a local committee appointed by them, of which William D. Hoxie is chairman. For Wednesday afternoon, December 8, an excursion is planned which members and guests will be asked to attend in a body, and during the balance of the time there will be opportunities for smaller parties to visit places of interest. In the evening there will be a more or less popular lecture for members and guests on agricultural machinery.

The professional papers assigned to the meeting are as follows: "Tests on a Venturi Meter for Boiler Feed," by Charles M. Allen; "The Pitot Tube as a Steam Meter," by George F. Gebhardt; "Efficiency Tests of Steam Nozzles," by F. H. Sibley and T. S. Kemble; "An Electric Gas Meter," by C. C. Thomas; "Tan Bark as a Boiler Fuel," by David M. Myers; "Cooling Towers for Steam and Gas Power Plants," by J. R. Bibbins; "Some Studies in Rolling Mill Engines," by W. P. Caine; "An Experience with Leaky Vertical Fire-Tube Boilers and the Best Form of Longitudinal Joint for Boilers," by F. W. Dean; "Testing Suction Gas Producers with a Koorting Ejector," by C. M. Garland and A. P. Kratz; "Bituminous Gas Producer," by J. R. Bibbins; "The Bucyrus Locomotive Pile Driver," by Walter Ferris; "Line-Shaft Efficiency, Mechanical and Economic," by Henry Hess; "Pump Valves and Valve Areas," and finally "A Report on Cast-Iron Test Bars," by A. F. Nagle.

In addition to the above papers there will be several valuable reports submitted by the several committees of the Gas Power Section.

THE NATIONAL DISTRICT HEATING ASSOCIATION.

FIRST ANNUAL CONVENTION, COLUMBUS, OHIO, NOVEMBER 10 AND 11.

The first annual convention of the National District Heating Association was held at the Great Southern Hotel, Columbus, Ohio, on November 10 and 11 last.

WEDNESDAY MORNING SESSION.

President A. C. Rogers called the first session to order on Wednesday morning, November 10, and then proceeded to deliver his address, for the title of which he took "The Objects of the Association, Past, Present and Future."

Mr. Rogers said that there were in Ohio about fifty district heating companies that are really auxiliary to electric generating companies. At the recent Toledo convention of the Ohio Electric Light Association he met about twenty-five men who were interested in district heating. After the completion of the convention some of these men and himself held a meeting and formed a temporary organization, with a membership of between five and ten. Some four hundred and fifty return reply postal cards were straightway sent out, and from each of the heating companies there was received either an affirmative reply or a communication asking for information. From this small beginning the association was formed.

Mr. Rogers opined that specialization in this line is yet in its infancy, that there is much to be accomplished, and that by meeting together results can be gained that will be very beneficial. He gave as his opinion that the future is a matter of time and development. He had a record of probably over five hundred district heating companies scattered through the United States. He ventured to hope by this organization to have an engineering spirit and a co-operation that will work for good and betterment of the district heating business.

H. W. Hillman, of Grand Rapids, Mich., formerly president of the Michigan Electric Association, enthusiastically congratulated Mr. Rogers and his associates who were responsible for the formation of the association. He went on to tell of the inter-relation of heating and electrical companies and said that the latter would give much support to the heating men. He spoke of the benefits of the autographic recording steam meter, which is not only a curve-drawing instrument, but an integrating meter as well. It will give the record of the variation in steam consumption every minute of the twenty-four hours and a cumulative record of the total consumption during the month. With regard to the value of this to the electrical end, he said that the steam meter could be taken right into the factory and connected on to the steam mains and tests made not only in connection with an ordinary machine shop or an ordinary factory, but in connection with a furniture factory, where steam is used for dry kilns, and for winter heating and for different purposes, such as in the vulcanizing department, and so on, of large companies. Then we will be able to know the exact horsepower-hours that they use for power and all kinds of heat.

Such a meter is also capable of installation in a building. A customer who has used steam at his own plant frequently makes the statement that last year and for several seasons it has cost him only six hundred dollars for coal. He does not want to add generator service; he never has any repairs to his boilers, and so on; and the result is that that is his cost. Now, with the old condensation meter there is no opportunity to install it in this instance and others which will develop like it; but this meter will be capable of installing in such a plant, and the instrument, with its variations and plugs, etc., will enable one to tell just exactly the amount of steam which that man is using and when he is using it.

At this point the president called upon the secretary to read the report of the committee on constitution and by-laws. The report was then presented and discussed, and after several amendments had been made, was duly adopted.

After some discussion on the time for holding the annual meetings and the advisability of affiliation with the National Electric Light Association, the president was authorized to appoint a committee on nomination and another on place and time of meetings. This concluded the morning session.

WEDNESDAY AFTERNOON SESSION.

The Wednesday afternoon session was called to order by the president at 2 p. m.

The secretary read the committee appointments as follows: Nominating committee, A. L. Bailey, H. W. Hillman and Robert Ilett; committee on convention, George D. Higgins, T. E. Riedhead and William Wolls.

G. C. Richardson, of the Builders' Iron Foundry, Providence, R. I., then addressed the convention on "The Venturi Meter and Its Use in Power Plants."

The author briefly related the history of water measurement from the time of the Romans down to that of Venturi, who in 1797 published a paper on his researches on the flow of fluids, in which he called attention to the sucking action at the end of a pipe in which water was flowing. Clemens Herschel, of Holyoke, in 1886, made the first practical application of this principle in a device which he modestly designated the Venturi meter. Connet and Jackson further improved on Herschel's work and evolved the so-called "Type D Register," which was characterized as making the Venturi meter "a practical working tool." This instrument showed directly on a dial the total number of gallons which had passed through the meter tube. The latter was connected to the register by two small pipes, one transmitting the inlet pressure and the other the throat pressure. To the register was later added a chart recorder which autographically recorded on a strip of paper the various rates of flow for every hour of the twenty-four.

The "Type D Register" with the chart recorder is still being placed on gravity-supply lines, the service for which it was designed. In many towns and cities it has disclosed interesting and unsuspected details of the water system, such as abnormal consumption, thefts of water, underground leaks of large magnitude and blow-off valves carelessly left open.

The Venturi meter, even in its early stages, was used also for measuring brine, hot feed water for boilers, etc.

The Type D Register and chart recorder, however, did not prove itself well adapted for metering hot water supplied to boilers, although in numerous instances the results have been very satisfactory. Frequently a meter tube and a manometer would fill the bill for this service, making a very simple, accurate and inexpensive combination. The standard manometer is essentially a U-tube half filled with mercury, one branch being piped to the inlet and the other to the throat of the meter tube placed in the feed line. The rate of flow in pounds per hour is shown directly on a scale between the two mercury columns.

Several years ago a new instrument was devised called a "recording manometer." This soon evolved into the "Type M Indicator-Recorder," the construction and principles of which the author explained by reference to actual instruments which he exhibited. The first Type M Recorder was placed in the boiler-feed line of a heating company's plant. Artistically, the initial charts were excellent,

representing as they did most naturally the rays of the setting sun. The pen worked night and day, back and forth, across the chart, with hardly a half hour's rest. This was the way the meter told the manager that his firemen were putting water into the boilers at most irregular rates. After some "moral suasion" on the manager's side the firemen got into the habit of watching the recorder, and this led to opening the feed valves less wide and less frequently, giving a much better chart, and consequently a much more even flow into the boilers. The manager considered this alone worth more than the cost of the meter.

For hot-water heating companies, the Venturi meter can be placed on the outgoing water. Then, knowing the temperature of the return water, the temperature of the outgoing and the number of pounds of outgoing as shown by the meter, the total number of heat units put into the system for each twenty-four hours can be determined. Knowing also the amount of coal burned and its calorific quality, the efficiency of the plant can be determined.

The Venturi meter is also entering the field of air, gas and steam with most promising results. Of these three, the measurement of steam is of prime importance, and experimental data on the subject are now in the course of preparation. It would, therefore, seem that the Venturi is destined to fulfill commercially its theoretical promise to "measure anything that flows;" in a word, to become a universal meter.

President Rogers then told of the successful application of the Venturi meter in the plant of which he is the superintendent of the heating system. He had also used the simple manometer tube that Mr. Richardson had mentioned, in order to measure the average gallons pumped per minute, from which can be obtained the total gallons per day and the total gallons per month. From this, with the coal charged up against the station, he was able, in a very satisfactory manner, to get the absolute heat unit sent out of that station into the hot-water heating system.

Professor Knight said that possibly, in measuring hot water used, with the expansion or evaporation of water, with the reduction of pressure, it would lead to a false pressure at the throat. There is bound to be a reduction of pressure at that point. He said that just as soon as the pressure in there is reduced, a certain amount of water will evaporate. He wondered whether or not that would cause the results to vary.

Mr. Richardson replied that in the Massachusetts Institute of Technology report on the Venturi meter (which he referred to in his paper), it was found that a certain amount of water evaporated. Tests were thereupon made which proved this amount to be small. All the meters are made for a standard temperature of sixty-two degrees Fahrenheit. For higher temperatures a correction must be applied, which is only two per cent for 212 degrees.

Mr. Hillman told, among other instances, of a case of a department store complaining about its bills for current. It was thought that the janitor was using too much light in connection with the cleaning out between six o'clock in the evening and eight o'clock the next morning. Therefore a curve-drawing water meter for the boiler was put on the first floor, and the first chart taken showed that, whereas the store required seven kilowatt-hours between a quarter of five and six o'clock, the janitor used nineteen kilowatt-hours during the night; he used three times as much current as they required in their business!

Mr. Stein told of several special makes of steam meters which could be used in a like connection.

C. R. Bishop, of the American District Steam Company, protested against a remark by a previous speaker that central heating stations do not know much about what they were doing. Most central heating companies that pretend to call themselves central heating companies, he said, not only know what their income is; they know every division of expense in their plant; they know what every factor of operation is; they have quite as complete records as anyone could ask. Even one of the southern towns keeps barometric records. One of the previous speakers, he said, wants the meter to show operating conditions. One can make as frequent readings as one wants to find out the periods of day in which water is used. His company had done this in its schoolhouse work. It was desired to find out whether the janitor was using as much after school hours as before. It is also true in churches, theatres, and buildings of that kind. They are all kept; there is no guessing at all. He knew plants that keep their transmission-loss data so carefully that their records are daily.

Mr. Hillman said he had met several men that morning who agreed with him that there was a deplorable lack of knowledge. They did not seem to know about their cost, and said they were glad to come there and knock elbows and learn from each other.

Mr. Gifford spoke of some experiments he had made on hot-water heating with a view to regulating the flow of water on each job. In these experiments it occurred to him that the Venturi meter would serve to get the difference in the head. He found by getting a valve made that he could control it very accurately by getting a one-inch valve. He stated from memory that he could deliver anywhere from twenty-four to 168 pounds of water per minute through the one-inch valve and that he could do that at a twenty-pound differential or five-pound differential. Furthermore, he could run it up to a forty-five-pound differential and get the same flow per minute. A valve of that kind seemed to him to be an important adjunct to hot-water heating. He thought it should be easy to develop along that line a cheap valve to do that work.

The secretary announced relative to the question of valves, that the Columbus Railway and Light Company is using a hot-water valve on the return end of the hot-water radiators supplied by them which has an adjustable orifice.

Some other gentlemen also contributed to the discussion, which proved to be of great interest.

The next number on the programme was a paper by Professor Knight, of the Ohio State University, Columbus, Ohio, on "The Determination of Deterioration in Underground Heating Mains."

Starting with the fundamental and axiomatic principle that anything which lessens the value of a plant, or that shortens its useful life, is a cause of depreciation, Professor Knight proceeded to state some of the chief of such causes as follows: (1) A piece of apparatus may become obsolete through a change in the methods of doing the work. (2) It may become less efficient in the performance of its duties as the natural wear and tear on it proceeds, until such time as a matter of economy it must be replaced by a new apparatus. (3) The apparatus may be such that its efficiency is not impaired by the wear and tear incident to use, nor to the effects of corrosion or decay. It would to the end perform its functions with its original efficiency. Here wearing out or decay would determine its life. (4) Through increased business a system or part of a system may become too small, so that it becomes

necessary to replace it with larger apparatus. In this case the apparatus may still be serviceable in a smaller capacity and would have a certain value when taken out. (5) Changes in the operation of a system or the discontinuance of some service may result in some part of it becoming useless. Without such changes these parts may still have a considerable period of usefulness, but are of such character that when once abandoned could not be made use of elsewhere. (6) Neglect to take proper care of or make necessary repairs on the apparatus. (7) Causes external to the plant, company or corporation, such as legislation affecting service, rates, franchise right, etc.

In an effort then to fix the depreciation of any system it is of the first importance to determine which of these causes are operative and to what extent. It is evident, too, that with a system of any magnitude some parts may be affected to a greater or less extent than others by the same causes. It seems logical, therefore, to divide the system up into as many parts as practicable and determine as accurately as possible to what extent each is affected by these various causes. In the final estimate each part is to be given a weight, equal to its rate times the proportion of its cost, to that of the whole plant.

While it is realized that the assignment of proper values to the different factors is, in the end, very largely a matter of judgment, it is believed that an average of the sum of a number of individual judgments is likely to be more nearly correct than a single one covering the whole system. In addition to this method of investigation, each suited to its own particular part can be applied, and thus a truer value of the depreciation of each part determined, this, of course, giving a more exact value to the whole.

The professor proceeded to show how the above principles work out in practice by considering in great detail a system made up of about 22,000 feet of pipe lines, forming the distributing system of a hot-water heating plant with pipes ranging up to one foot in diameter.

A most interesting discussion followed the reading of Professor Knight's valuable paper. Several members spoke on the depreciation of pipe and conduit, the causes thereof, and their experiences in the way of remedies.

President Rogers said his company had good results in putting in conduit with oil-treated hemlock shavings. Even after twelve years the pipes were in good condition, even the mill marks being plainly discernible.

Mr. Harding had had trouble due to the acids naturally in the soil which caused such corrosion that the pipes had to be relaid every three years.

Mr. Gifford said that, regarding the soil, he had noticed in his experience, the wood boxing stands up better in clay than it does in sand. In three or four instances he had had to take up lines which had been in sand and gravel, very porous soil, enclosed in two thicknesses of two-inch hemlock, for five years; the first thickness was entirely gone and the second thickness had just started to be attacked. But the shavings and the boxing protecting the piping, and the pen marks and the mill marks were still on it. He opined that the air has something to do with causing rot, and the more porous the soil the worse it is for the wood conduit. He had had occasion to take up some line that had gone through a cinder yard of a plant. Cinders were a very bad proposition. It seemed to him that clay answered the purpose as well as any soil.

Secretary Wolls stated that in investigations on the Columbus plant, the test for electrolysis was made on these mains and none was found to exist. Answering a question by Mr. Bishop, he said that one of the main lines passes under three different street-railway tracks, and, of course, the neutral of the railway is grounded. Tests were made for electrolysis on two other portions of the system and no deflection on the instrument was obtained.

This concluded the discussion.

On the motion of Mr. Harding, a hearty vote of thanks was unanimously accorded to Mr. Richardson and Professor Knight for their papers.

The next paper presented was by W. E. Taylor, of Toledo, Ohio, on "Thermostats and Thermostatic Action."

Mr. Taylor said, in part, as follows:

"A thermostat is nothing more or less than an automatic valve operated by a variation in temperature by means of an element whose action is more or less uniform under a change of temperature. Under a rise in temperature this element expands and when the temperature falls it contracts, and it is this expansion and contraction that controls the compressed air, which in turn operates the system.

"In one type of thermostat the element consists of a strip of brass and steel welded together. These metals have a different coefficient of expansion, and being welded together the expansion causes the strip to buckle, thereby opening and closing an air port. Another type uses a liquid called 'Rigolin' enclosed within a metal disk. This liquid boils at a very low temperature, and at a temperature of seventy degrees Fahrenheit it generates a vapor which causes the disk to become inflated or deflated, thus operating an air valve. A third type uses for its sensitive element a tube of hard rubber. Within this tube is a piston connected with an air valve, and as the tube expands or contracts, the air valve is opened or closed.

"The ideal system of heating should consist of many points of supply in numerous small units, but here is where the cost interferes with the result. The quantity of heat is supplied by means of fewer units, resulting in abnormal temperatures in the immediate vicinity of the units and variation at any other points of the room, a condition beyond the power of any regulating system to control, unless the units of control are divided with as many as there are changes of temperature.

"Thermostats as used today operate on averages. I do not know that any condition created or met by district heating systems influences the position of the thermostat. Some of you have them in use on your systems, some operating on averages, others, perhaps, more closely fulfilling their function, depending upon the character of your work, but I am safe in saying that as a rule they give reasonable satisfaction where installed for duty within the range of their action."

Mr. Riedhead asked if there is a system of thermostatic control for steam heat where the customer is using heat on a flat-rate basis, which would be fair, of course, to the companies furnishing heat.

President Rogers gave as his opinion that the question was a very general one. He considered the thermostat as quite essential, even where a condensation meter is used. He regarded it as essential to the buyer of the heat.

Mr. Taylor said he should have stated that the economy generally attributed to the use of automatic temperature regulation has been very accurately estimated to be about thirty to thirty-five per cent. He thought that answered the question.

President Rogers said he did not know of any steam apparatus that has not some thermostat governing those conditions, nor of any steam heating without thermostats.

Mr. Gifford stated that in his experience in heating thermostatic control

was always adopted. He agreed with Mr. Taylor that the saving was about thirty per cent. The thermostat was certainly an advantage to the customer and to the operating company. If placing a thermostatic control on the shop would save the operating company any heat, it is, of course, an advantage to them. On a meter basis, it will save the consumer some money. The trouble with compressed air has been that the air line in the street has deteriorated and gone down. He knew of a number of instances where this had happened, both from soil conditions and possibly from corrosion or electrolysis; and there have been devices put out on the market that would handle it from local conditions. From various tests he had made he figured on at least thirty to thirty-five per cent control. He did not think that plants that have them would give them up.

Mr. Bishop said that if you can regulate the windows like they do in a schoolhouse, and everything is arranged on that basis, the thermostatic regulation works out very decidedly in favor of the company, but where it helps the public to waste the heat, as by leaving the windows open (the thermostat regulating the temperature to still keep the room warm), it is not quite so profitable.

Professor Knight said that what was wanted was an automatic regulator to shut steam off when the windows and doors are open.

After some further remarks by other speakers, President Rogers closed the discussion with some entertaining observations on the human element to be considered in the matter.

After the close of the above discussion, the members present were agreeably entertained by E. C. Adams, of the Anchor Packing Company, Detroit, Mich., with sleight-of-hand tricks in "An Hour with the Mysterious."

This closed the Wednesday's proceedings.

THURSDAY MORNING SESSION.

The Thursday morning session was called to order by the president at 9 a. m., when, after some routine business matters had been disposed of, Harold McGeorge, of Cleveland, Ohio, proceeded to read his paper on "Air Leakage Around Windows; Its Prevention, and Effect on Radiation." An interesting discussion followed.

The president thereupon introduced to the meeting Mr. Gaskell, secretary of the Ohio Electric Light Association. Mr. Gaskell, who was greeted with applause, said that from his personal observation of the convention, the affair was most earnest and praiseworthy. He emphasized the necessity of making the association of practical value to its members. In order to make it an assured success it was necessary to keep it constantly in touch with the district heating companies of the country, so that it would be desirable for each and every one of them to become a member of the association. To this end it was advisable first to publish the proceedings, even if it were necessary to get advertising to raise the money, although he thought it were better compatible with the dignity of the association to avoid raising money in this way if possible.

He told of the experiences of the Ohio Electric Lighting Association in regard to the distribution of its proceedings, it being found advisable to distribute free copies only to members and to those who read papers before the association, thereby making it an extra inducement for outside companies to join, in order to obtain the bound volumes of the transactions of the conventions. He advised the sending out of an immediate circular letter to all the district heating companies in the United States, advising them that they would receive a printed copy of the 1909 Proceedings of the association provided they sent in an application for membership and remitted the dues for 1910.

With regard to the necessity for keeping the association constantly before the public, Mr. Gaskell advised the convention that it was necessary to work twelve months of the year and not only at convention times. The central office of the association should always be ready to answer with dispatch all inquiries of any nature that may arise, and a committee of members should be appointed to attend to this department. The men appointed on the committee should be experts and all questions should also be discussed further at the annual meeting, so that such matter may be printed in the proceedings, so as to be available for record. By these means would the association be made of intense practical value to its members and its prosperity be assured.

Mr. Gaskell went on to speak of the advisability of admitting manufacturing companies and the like as associate members, a policy which had been adopted with much success by various electrical associations throughout the country. He also recommended that considerable attention be paid to entertainment features, and furthermore suggested, that for a three days' convention, ten papers would be found ample to listen to and discuss. In conclusion, Mr. Gaskell made the very excellent suggestion that all papers should be printed and distributed ahead of time. This would not only enable a paper to be read when its author was unavoidably absent, but would permit the members to read up the subject and so be better prepared for the discussion.

Mr. Gaskell's remarks were received at the finish with loud applause.

The president heartily thanked the speaker for his instructive discourse and remarked that the association would duly profit thereby. In closing the session he communicated the information that Mr. Wolls had extended an invitation to the members to visit the Mound Street Heating Plant in the city, of the Columbus Railway and Light Company. He therefore adjourned the convention until 2 p. m. to enable the members to avail themselves of this excellent opportunity.

THURSDAY AFTERNOON SESSION.

The Thursday afternoon session was devoted chiefly to the reading of the following papers: "Some Remarks on District Steam Heating," by W. J. Kline, of the American District Steam Company, of Lockport, N. Y.; "Heating and Ventilating a Modern Building," by H. W. Woodward, of Cleveland, Ohio.

The election of officers was also settled, after the first recommendation of the Nominating Committee had been declared lost for lack of a seconder to the motion for acceptance. Eventually A. C. Rogers, superintendent of heating of the Toledo Railways and Light Company, Toledo, Ohio, who was president of the tentative organization, was unanimously elected president. J. H. Harding, of Laporte, Ind., is the first vice-president, H. W. Hillman, of Grand Rapids, Mich., the second vice-president, and F. E. Riedhead, of Paducah, Ky., third vice-president.

The new secretary-treasurer is D. L. Gaskill, of Greenville, Ohio. Mr. Gaskill is also secretary of the Ohio Electric Light Association. Grant Miller, of Toledo, Ohio, and W. A. Wolls, of Columbus, Ohio, are directors.

Iowa Telephone Companies Prosper.

The net assessment of the telephone and telegraph lines in Iowa amounts to $3,661,946.88, according to the tenth annual report of the executive council on the assessment of telephone and telegraph companies. The total pole mileage amounts to 82,608.72 miles.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

THE TITANIUM ARC.[1]

BY WILLIAM S. WEEDON.

Many years ago a series of experiments was started in order to determine which substance, among the materials available, would give the maximum light efficiency when used as arc electrodes. The work covered a large number of elements, compounds and mixtures, with considerable variation in the preliminary treatment.

Among the substances that were tried there was none which gave as high efficiency in candlepower per watt, as material which contained the element titanium. Of these materials the carbide of titanium can be obtained in the market in several forms, and as this is probably the most convenient and important material in this work, its varieties are given.

1. Carbide containing more carbon than is necessary to form the combination TiC, in which the excess of carbon is in the form of graphite.

2. Carbide containing only as much carbon as is necessary to form the carbide TiC, or less than this amount, the latter kind being in all probability a mixture of the carbide TiC and metallic titanium, a small amount of iron also being present.

3. Carbide containing a rather low percentage of carbon and a fairly high percentage of iron.

In the early stages of the experiments the second class of material seemed to be the most satisfactory, while the third class gives an arc which possesses certain objectionable characteristics. In particular the presence of iron seems to cause unsteadiness. As is well known, metallic arcs are far from steady under ordinary circumstances, and in this case the iron seems to accentuate the tendency to unsteadiness.

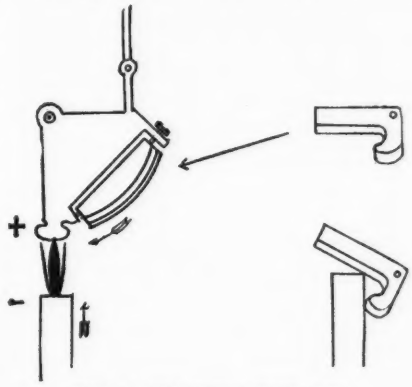


FIG. 1.—STARTING THE ARC.

CHARACTERISTICS OF THE TITANIUM ARC WITH DIRECT CURRENT.

The arc, as obtained from the carbide, possesses an extremely luminous inner path, while little light is given by the outer mantle and none whatever by the craters. To give the best results the titanium carbide electrode should be the cathode and placed below an anode of copper, the latter being inactive and not wasting appreciably. The light is almost pure white, only the faintest tinge of yellow being noticed when observed from a distance.

After running for some time, there is deposited a "button" of titanium oxide on the copper anode, which causes unsteadiness at times. The phenomenon known as "hissing" or "positive blow" occurs occasionally, resulting in the production of a peculiar jet of flame from the anode, in a consequent variation in light intensity, and in a decrease in voltage across the arc. Further, another difficulty is caused by the formation of an oxide layer on the surface of the titanium carbide electrode. It will be seen that this leads to complications in starting the arc after it has

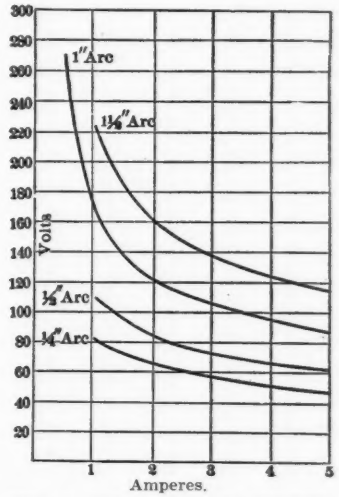


FIG. 2.—VOLT-AMPERE CURVES.

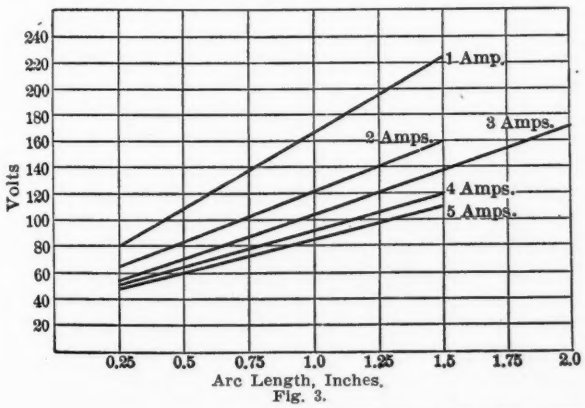


Fig. 3.

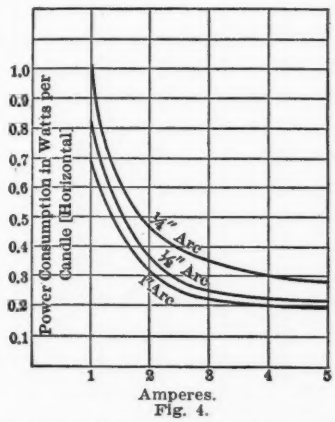


Fig. 4.

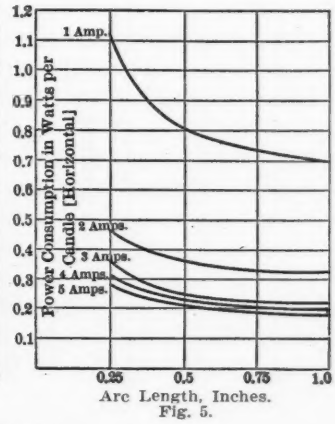


Fig. 5.

CHARACTERISTIC CURVES, TITANIUM ARC LAMPS FOR DIRECT CURRENT.

[1] A paper read before the American Electrochemical Society at New York on October 28, 1909.

been extinguished for a short time, since the oxide is non-conducting.

The button on the anode does not offer serious difficulty, since a device by Mr. Halverson, designed for the magnetite lamp, overcomes this obstacle. The device referred to is an anode "rocker" connected with the lamp mechanism, so that the arc plays upon one portion of the anode while running, but strikes from another portion. By adapting this idea of the rocker anode, it has been found possible to strike the arc, even though the cathode and anode both have non-conducting surfaces. The starter and method of operation are shown in Fig. 1.

It will be seen that the arc is struck from the side of the lower electrode just below the tip, and after the current is established the electrodes return to running position, the arc running along the anode and climbing the cathode until it also is in normal position.

show that titanium carbide arcs are most satisfactorily operated on a constant-current circuit rather than on a low-voltage multiple circuit (with the necessarily short arc length).

Some photographs have been taken in order to give a comparison of the various arcs. Since these were taken through the globe, the reflection of the flame is some-

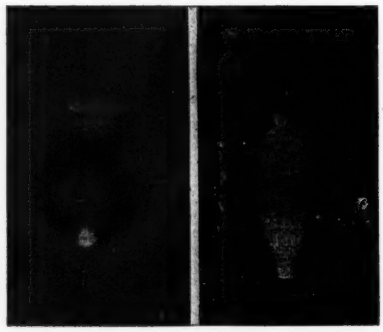


Fig. 6. Fig. 7.

the inner path giving a large portion of the light, but the outer mantle also luminous.

Fig. 9. The titanium arc. Lower electrode (cathode) titanium carbide. Upper electrode copper. Arc length one inch, current three amperes. Structure very clearly defined, inner path giving nearly all the light.

Fig. 10. Same as Fig. 9, but showing tendency for the outer mantle to form in layers. This occurs occasionally, and does not interfere with the steadiness of the arc.

Fig. 11. Titanium arc, flickering due to air currents. This arc is very sensitive, and the air currents must be controlled carefully by suitable draft arrangements.

Fig. 12. This shows the tendency of the titanium arc to "crawl" up the side of the anode, owing to air currents or improper centering of electrodes.

Fig. 13. The titanium arc is also sensi-

Fig. 8. Fig. 9. Fig. 10. Fig. 11. Fig. 12. Fig. 13. Fig. 14.

CHARACTERISTIC APPEARANCE OF VARIOUS ARCS.

The titanium arc is a flame arc, and the efficiency increases with increase in current density and with increase in arc length. The volt-ampere curves are given in Fig. 2, and the volt-arc-length curves in Fig. 3. The power-consumption curves, shown in Figs. 4 and 5, indicate that we have here a very efficient arc. At three amperes, 103 volts and one-inch arc length, we have only 0.228 watt per horizontal candlepower. The mean spherical candlepower at 2.87 ampers, ninety-five volts (273 watts), is 535, and the mean hemispherical candlepower 737.6. On this basis the power consumption is 0.51 watt per mean spherical candlepower and 0.37 watt per mean hemispherical candlepower; this corresponds to an efficiency of 1.96 mean spherical candlepower, or 2.70 mean hemispherical candlepower per watt.

The electrical measurements given were made at the arc terminals, and the photometric measurements were made through a clear glass globe of the usual thickness.

A study of the efficiency curves will

times reproduced in the photographs, and should not be confused with the arc itself.

Fig. 6 shows the plain carbon arc. Note the absence of light in the arc stream, while the terminals are very luminous.

Fig. 7 shows the arc obtained from Conradty's flame carbons. The arc stream is luminous as well as the terminals, but

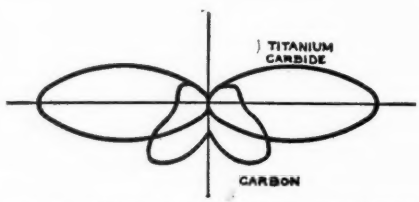


FIG. 15.—LIGHT DISTRIBUTION FROM CARBON AND TITANIUM ARCS.

there is an entire lack of structure in the flame.

Fig. 8. Magnetite as cathode and copper as anode. Arc length one inch, current three amperes. No light is given off by the terminals, and all comes from the path of the arc. Structure shown clearly,

tive to irregularities in the composition of the electrode. In this photograph a dark space is observed around the anode, and this causes flickering. The titanium used contained iron.

Fig. 14. This photograph is not very clear, owing to the confusion caused by the reflection in the globe. It represents the tendency to darken around the cathode, and this seems to be due to the presence of some impurity in the carbide. At times the dark space will appear, extending part of the way up into the arc from the cathode, and often will dance up and down for some time. It differs from the darkening around the anode in that its limit is sharply defined. When pure carbide is used this does not often occur.

As is to be expected, the distribution of light from the titanium arc is quite different from that of the carbon arc. Fig. 15 will serve to show the difference in this respect, although the figure is not drawn to scale. It is to be noted that flame arcs are better for street illumina-

tion than the ordinary carbon arc, even at the same mean spherical candlepower.

PREPARATION OF THE TITANIUM CARBIDE ELECTRODES.

For the initial experiments the electrodes were made as follows: The lump material is coarsely powdered and then pulverized in a ball mill to a high degree of fineness. It was then worked in a roller mill with oil, glycerine or other suitable binder. After the material was thoroughly plastic it was extruded through a nozzle by means of a hydraulic press, the sticks being cut to suitable lengths.

After drying at ordinary temperatures, and then in a gas oven, the electrodes were fired at high temperature, preferably in an electric furnace of the carbon-tube type. After firing, the sticks should be firm and without cracks. If fired at too high a temperature they are liable to be brittle.

It was thought necessary to copper plate the electrode to prevent oxidation during burning in the lamp. This phenomenon is characteristic of titanium carbide. A bare electrode oxidizes at a point one-eighth to one-fourth inch below the tip, the stick swells, and the top falls off. The copper plating effectually prevented this, and did not interfere materially with the running of the arc.

The life of the carbide stick varies, of course, with the current density and inversely with the diameter of the electrode. At about three amperes a stick one-half-inch in diameter wastes away at the rate of one-fifteenth to one-tenth-inch per hour.

During the running of the arc the whole of the upper surface of the electrode does not melt, but simply appears moist at the point at which the arc is playing. The more nearly the composition of the stick approaches metallic titanium, the higher the melting point, and it is certain, from a number of experiments made in connection with the preparation of these sticks, that metallic titanium is one of the most refractory metals known.

The titanium carbide arc may also be operated with alternating current under certain conditions, but the results of this work cannot be presented at the present time.

THE TITANIUM SUB-OXIDE ARC WITH DIRECT CURRENT.

The material used in these experiments was prepared in the electric furnace by the reduction of rutile. Its preparation is quite easy, since the melting point of the product is much lower than that of the carbide.

The character of the arc is almost identical with that of the carbide arc, but the light is much steadier and the tip of the electrode does not oxidize and fall off. It is, therefore, not necessary to plate the sticks or cover them with a metallic sheath.

There are certain objections to this electrode, and among these are the tendency to form large, troublesome deposits on the anode, and the fairly rapid consumption of the sub-oxide stick.

The sub-oxide gives a light efficiency even better than that of the carbide. At 3.4 amperes, seven-eighths-inch arc length and 100 volts, 2,100 candles (horizontal) are obtained. This gives a power consumption of 0.162 watt per horizontal candlepower, or an efficiency of 6.17 horizontal candlepower per watt. The distribution of the light is the same as with the carbide.

The heavy deposit on the anode is probably responsible for the fact that the difference in potential between the terminals is about fifteen volts higher than is the case with the carbide at equal arc length and current.

The sub-oxide electrodes cannot well be operated with alternating current, this being due to difficulties caused by rectification.

The above work was carried out in the research laboratory of the General Electric Company.

Production of Titanium.

Titanium ore in the form of rutile, which is titanium dioxide, has been mined in Nelson County, Virginia, where a plant has been erected to extract the metal from the ore. Titaniferous iron ores are mined in New York, Minnesota and Wyoming.

Aside from its rapidly increasing use in the manufacture of arc-lamp electrodes, titanium is used to increase the toughness of steel and cast-iron. Rails treated with titanium and laid in places on railroads where the wear was especially hard are said to have shown much less wear than untreated rails.

A report on the production of titanium and other rare metals in 1908, prepared by Frank L. Hess, has just been issued by the United States Geological Survey and may be obtain free by application to the director of the Survey, at Washington, D. C.

The Philadelphia Electric Company has been authorized to install 171 additional and ornamental arc lamps on Market Street, between Second and Sixteenth streets.

PUBLIC LIGHTING FIXTURES FOR ARC LAMPS.

BY GILBERT MULOCK.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of November 13, H. Thurston Owens said many complimentary things concerning street-lighting conditions abroad, especially as regards the fixtures in use. The writer is glad to see attention directed to this important and sadly neglected subject. Not long ago the following item appeared in a daily paper, which would make it appear as though

FIG. 1.—MODEST AND UNOBTRUSIVE.

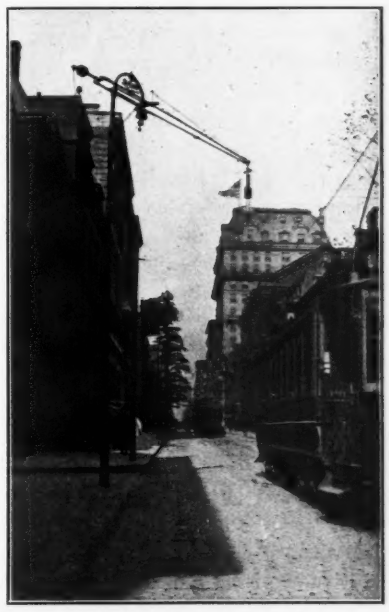


FIG. 2.—CONSPICUOUS BUT GROTESQUE.

some interest was being taken in the subject:

"LIGHTING PROBLEM SOLVED.—The municipal-lighting problem has practically been solved, one of the latest agents being the 'Flaming Arc' light of 3,000 candlepower and upward. * * * * Los Angeles, Denver and other cities are turning their attention to making street lighting ornamental, as well as useful. Detroit is one of the cities having towers up to 2,000 feet high bearing powerful electric lights. * * * * Besides electricity, many municipalities are lighted by gas, acetylene, gasoline and benzine."

FIG. 3.—BOTH THE OLD AND NEW.

Probably the most interesting portion of the above statement is contained in the intelligence that benzine is included in the list of modern illuminants. While it is true that we have made long strides in the improvement of interior illumination. street lighting in this country is still largely in its infancy, and is far from being satisfactorily solved.

The writer has at random been collecting notes and snapshots of the good and bad in street lighting, but these are confined to American installations. Some of these are given in the following. Where overhead wiring is in use for lighting circuits it is frequently essential for many reasons that the lamps be hung from the poles which carry the lines. For such a condition the lamp shown in Fig. 1 is, in the writer's opinion, unobtrusive and well located.

Let us now turn to Fig. 2, which is a grotesque lamp-post on an important street, where the lamps are supplied through underground conduits. The one feature of interior lighting which has justly received the greatest attention since the advent of illuminating engineering is that of the importance of keeping light sources of high intrinsic brilliancy out of the line of vision. The same should hold good in exterior lighting, and it seems

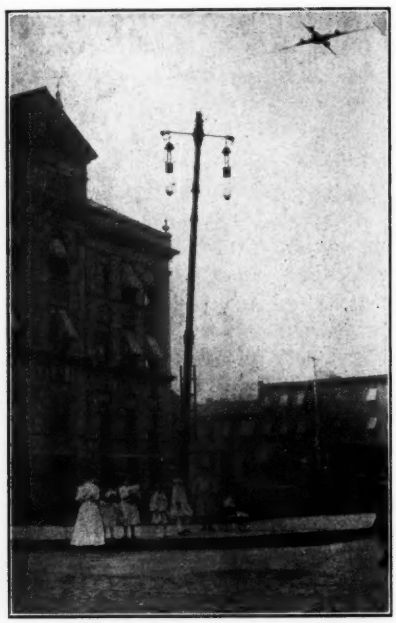


FIG. 4.—AN OLD-TIMER.

odd in this enlightened age to see an equipment which would have proved satisfactory from a lighting standpoint changed for reasons which evidently per-

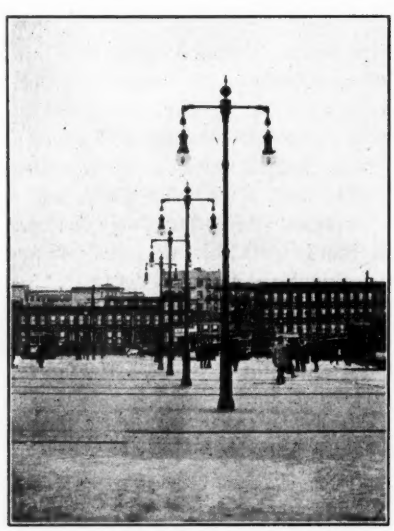


FIG. 5.—CLEAR GLOBES SPOIL THE EFFECT.

tain to operation. The lamp was formerly suspended from the "crook" close to the curb, but now an unsightly mast arm has been added, so that the full 2,000 (?) candlepower of the open arc lamp may be utilized to its detriment.

We heard some time ago that the open arc had seen its day, but there are a few thousand with us yet. When the change from the open to the enclosed type is made care is not always taken to remove the unsightly and unnecessary hood, and that shown in Fig. 3 hangs over the door of the city hall of a good-sized, prosperous community.

As city halls offer good examples, we will see by examining Fig. 4 a post which adorns the grounds of one, in a city which stands among the first twenty in point of population. If the post were straightened, the lamps changed to the flame type and the ladder removed to a less conspicuous location, it could be said that art and utility were combined to enlighten and please.

Attention to details is essential if we are to raise our public lighting to a standard which will be the equal if not the envy of Europe. The lamps shown in Fig. 5 are installed at a trolley terminal and are admirably located, but the alternate glare and shadows from clear lamps hung less than twenty feet above the street level are most objectionable. Alabaster globes and a flexible-pipe joint in place of the plain wires forming the connection between the lamp and pole would raise this installation from mediocrity to merit.

Referring again to Mr. Owens' article, we find an illustration of an artistic fixture in Berlin, where the trimmer has lowered the lamps for cleaning, and while

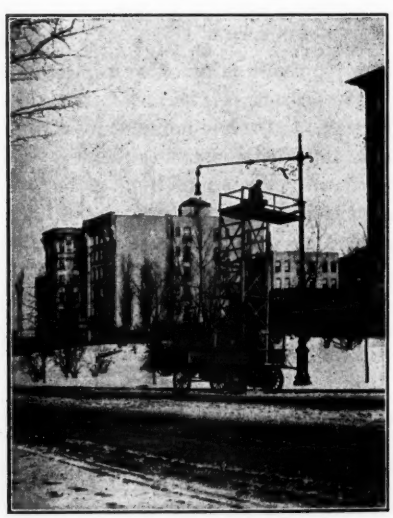
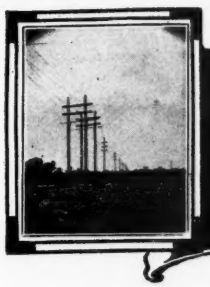


FIG. 6.—AN EXCELLENT EQUIPMENT.

this is better than climbing a high pole, why not use an electric auto with a skeleton tower, such as that shown in Fig. 6? Notice also the contrast between the fixture shown here and that in Fig. 2; one costs as much a year as the other.



CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

DEVELOPMENT OF ELECTRICAL UNDERTAKINGS.[1]—I.

BY S. J. WATSON.[2]

It is, I believe, usual that a chairman's address at the commencement of each session should deal with some particular subject, and I, therefore, propose to make a survey of various points of interest in connection with the development of electric supply undertakings during the past fifteen years. I have personally been engaged with supply undertakings for about seventeen years, and may fairly claim to have been closely in touch with the subject.

In looking backward, one cannot help but be impressed with the remarkable growth that has taken place during a comparatively short period of time, and the tremendous amount of work involved in the equipment and setting to work of the various power stations with their distributing systems.

Complete statistics are, unfortunately, not available, but, in order to illustrate the growth that has taken place, I have prepared a table, giving a summary of the records contained in issues of certain English electrical papers in 1894, 1899, 1904 and 1909, so that you will see, and, I hope, appreciate, the improvements which have taken place during three periods, each of five years.

It is no small thing to find that the amount of capital invested has increased from four to nearly sixty millions of pounds ($300,000,000) in fifteen years, but such a fact does not necessarily imply that the capital is being employed to greater advantage from the engineering or even from the financial point of view, and in order to show that progress has, indeed, been made, I have also shown on the table (the English pound sterling has been taken as the equivalent of $5.00) what the increase has been during each period of five years, and the extra cost of dealing with such increase.

This method of ascertaining the cost of the extra units sold from year to year, and also the extra capital charges incurred in supplying the extra units, gives some very valuable assistance when working out the price to be charged to cover the cost of supplying large consumers. I have personally used this method for some years, and you may, perhaps, be interested to know that applying it to the past seven years' records of the undertaking with which I am connected, during which time the output has increased nearly tenfold, and large extensions have been carried out to plant and mains, I find that the extra generating costs amount to 0.586 of a cent per unit, the extra capital charges on plant to 0.308 of a cent per unit, the extra distributing costs, *i. e.*, repairs and capital charges on mains, etc., to 0.468 of a cent per unit, and the extra management charges to 0.174 of a cent per unit, so that the total additional cost of supplying the extra units amounts to 1.536 cents per unit. The load factor of the increased output has been 23.2 per cent.

The figures given in the table need little explanation, but I would particularly call your attention to the fact that the capital cost per kilowatt of plant and mains installed has decreased from $695.00 in 1894 to $360.00 in 1909, the number of units sold per $5.00 of capital invested has increased from 3.4 to 14.2, the average price charged has been reduced from 12.32 cents to 4.32 cents per unit, and the gross profit has gone up from 3.3 per cent to 6.6 per cent. It is also of interest to note that, whereas the cost of the plant and mains added during the period 1894 to 1899 was $460.00 per kilowatt, the cost of the additions during the period 1904 to 1909 was only $285.00 per kilowatt, and that the additional working expenses for the increase in the output between 1894 and 1899 was 4.26 cents per unit, whereas the cost for the increase in output between 1904 and 1909 was only 1.36 cents per unit. A number of other contrasts might be made, but I will only mention that there is a difference of 293,095 kilowatts between the total capacity of the plant installed and the maximum load recorded, that is to say, that no less than thirty-seven per cent of the total plant is provided as spare. This represents a capital expenditure of over $30,000,000.00, which is entirely unproductive, inasmuch as it does not earn one penny of income. In this connection I would remind you that Parliament has recently granted powers to the London supply undertakings to interconnect their power stations. It is evident from these figures that such permission was badly

RECORDS OF SUPPLY UNDERTAKINGS.

Year	1894.	1899.	1904.	1909.
Number of undertakings	30	100	225	290
Capital expenditure	$ 22,364,625.00	$ 59,479,965.00	$191,422,290.00	$289,090,710.00
Plant installed	32,108 kw.	112,631 kw.	454,565 kw.	795,036 kw.
Increase in capital	.....	$ 37,115,340.00	$131,942,325.00	$ 97,668,420.00
Increase in plant	.....	80,523 kw.	341,934 kw.	340,471 kw.
Capital outlay per kilowatt	$695.00	$525.00	$420.00	$360.00
Cost per additional kilowatt	.....	460.00	385.00	285.00
Maximum load	.....	78,866 kw.	269,680 kw.	501,941 kw.
Per cent to plant installed	.....	70 per cent	59 per cent	63 per cent
Units sold	15,231,181	76,432,250	349,003,935	824,819,503
Increase in output	.....	61,201,069	272,571,685	475,815,568
Per cent increase	.....	410 per cent	357 per cent	156 per cent
Units sold per $5.00 expenditure	3.4	6.4	9.1	14.2
Units per additional $5.00 expenditure	.....	8.2	10.3	24.4
Revenue	$ 1,960,385.00	$ 7,781,310.00	$ 23,815,555.00	$ 37,641,605.00
Per cent to capital	8.7 per cent	13.1 per cent	12.4 per cent	12.8 per cent
Increase in revenue	.....	$ 5,820,925.00	$ 16,034,245.00	$ 13,326,050.00
Revenue per unit	12.32 cents	9.78 cents	6.54 cents	4.32 cents
Revenue per additional unit	.....	9.10 cents	4.64 cents	2.68 cents
Working expenses	$ 1,215,105.00	$ 3,930,575.00	$ 11,670,440.00	$ 18,407,520.00
Per cent to revenue	62 per cent	51 per cent	49 per cent	49 per cent
Cost per unit	7.64 cents	4.94 cents	3.20 cents	2.14 cents
Cost of additional units	.....	$ 2,715,470.00	$ 7,739,865.00	$ 6,737,080.00
Cost per additional unit	.....	4.26 cents	2.72 cents	1.36 cents
Gross profit	$745,280.00	$ 3,850,735.00	$ 12,145,140.00	$ 19,234,085.00
Per cent to capital	3.3 per cent	6.4 per cent	6.3 per cent	6.6 per cent
Increase in gross profit	.....	$ 3,105,455.00	$ 8,294,390.00	$ 7,088,970.00
Per cent to additional capital	.....	8.3 per cent	6.3 per cent	7.2 per cent
Load factor total output	.....	11.0 per cent	14.7 per cent	18.7 per cent
Load factor additional output	.....	.....	16.3 per cent	23.3 per cent

[1] Chairman's address at opening meeting, Institution of Electrical Engineers, Manchester (Eng.) Section, October 22.

[2] Borough Electrical Engineer, Bury, Eng.

Note.—The English money values have been changed in all cases to approximate American figures.

wanted. There is no doubt that where power stations are situated within a reasonable distance of each other, the cost of running interconnecting cables would be small compared with the saving of expenditure on plant.

I roughly estimate that within a distance of eight or ten miles of the Manchester (Eng.) Town Hall there are some twenty public generating stations, having between them a total capacity of 100,000 kilowatts, which has probably cost over ten million dollars. To construct a system of mains partly above and partly below ground so as to interconnect these generating stations would cost about $750,000.00, but by so doing it would be possible to reduce the quantity of spare plant from thirty-seven per cent to, say, twelve per cent, and enable the existing stations to supply an increase in load of 25,000 kilowatts without any further expenditure, thus making use of existing plant, having a value of about $2,500,000.00 at a cost of $750,000.00 on mains. Some additional expenditure would be necessary to provide converters at some of the existing works, but against this might be put the saving in working expenses through running the plant at higher efficiencies.

It was about the year 1894 that the fight was taking place between the respective advocates of high-tension alternating and low-tension direct-current systems. Judged in the light of later knowledge, it must be admitted that both sides had very good grounds for their arguments. The generation of high-tension alternating currents for transmission over large areas has become the standard practice, although, by the way, such currents are not single, but multiphase, and low-tension direct current is still very largely employed, and, in point of fact, absolutely essential for many purposes, although the pressure now used is mostly 220 or 440 volts instead of 100.

In the earlier years of their existence there is no doubt that much better results were obtained from the direct currents than from the alternating-current stations, owing to the assistance of storage batteries, which in nearly all cases formed part of the equipment, and also to the much higher efficiency of the distributing systems, but at the present time, principally owing to the increase in the outputs and in the supply area, and also to improvements in alternating-current transformers, there is very little difference between the results obtained from either system.

Bearing in mind the rapidity with which power stations were constructed one after the other about 1894, it may be said that, with the knowledge and experience then available, the majority of the work was carried out on lines that have very well withstood the test of time. On carefully considering the matter, it appears to me that only one serious mistake was made, which has only become apparent as one extension after another has had to be carried out to meet the demands of a rapidly increasing business. I refer to the somewhat common practice originally adopted of erecting the generating stations in thickly populated districts in order to keep down the expenditure on mains, without taking into consideration either the facilities provided for obtaining delivery of fuel, the provision of an adequate supply of water for condensing purposes, or providing ample room for extensions.

The growth which has taken place was very much underestimated, and in consequence of this want of foresight, it has been necessary in many cases to construct new generating stations on more suitable sites, or to make good the deficiencies of the existing sites at considerable expense.

The reductions in the average cost per unit between 1894 and 1909 is, of course, appreciable, and has been brought about principally through the increase in the output and the better load-factor conditions, but these influences, important as they undoubtedly are, would not appear to be sufficient to account for the reduction which has taken place in the fuel cost, and, speaking broadly, there has not been any considerable change in the design or arrangement of generating plants to account for this reduction. Not the least important factor has been the increase in the size of generating sets. The limit appeared to have been reached with the 500-kilowatt bipolar machine, but with the advent of the multipolar design, largely through being able to use carbon brushes, the sizes rapidly increased to about 1,500 kilowatts, and today the Manchester turbine-alternators of 6,000 kilowatts are the largest in use in this country, although one hears of 10,000 and 15,000-kilowatt sets being used on the European and American continents.

In dealing with the changes that have taken place in connection with prime-movers, one is bound to make some reference to the steam turbine, which, although obtainable in the smaller sizes as far back as 1894, was not generally accepted as a satisfactory article in the larger sizes until five or six years ago. For alternating currents, plants of 1,000 kilowatts and upward, turbines have now, however, become standard practice.

In the early nineties a difference of opinion existed as to the relative advantages of single-acting and double-acting engines; a similar problem is with us today in regard to the principle of turbine construction. With the small plants of, say, 250 kilowatts used in the past, it would probably have been difficult to prove that any great difference existed between one type of engine and the other, although in the still larger sizes the double-acting engine has been the most successful. At the present time equally good results are apparently being obtained from both the impulse and the reaction type of turbine, but if we accept as a sign of the times what is being done in other countries, it would appear that the impulse machine is being used to an increasing extent in the large sizes. The tendency of turbine construction is to increase the clearances, reduce the number of stages, and to shorten the length between bearings, and progress along these lines is likely to be more successful with the impulse rather than with the reaction machine.

A question of some importance to supply undertakings is to what extent the costs can be reduced by the employment of exhaust-steam turbines. Many generating stations are wholly or partly equipped with reciprocating engines, and the advisability or otherwise of installing exhaust turbines to work in connection with such plants requires consideration.

The advantages to be derived are twofold: (1) The total capacity of the plant will be increased by an expenditure on the turbine sets only without any extensions of steam-raising plants. (2) The fuel consumption will be appreciably reduced.

In order to illustrate the effect of installing exhaust turbines in an existing generating station, it will, perhaps, be of interest to work out an example, and I, therefore, assume a case where 4,000 kilowatts of reciprocating plant is installed, consisting of six compound sets having a capacity of 2,000 kilowatts, and two triple-expansion 1,000-kilowatt sets. With a moderate degree of superheat and a vacuum of twenty-six inches, the steam consumption at full load, excluding condensers and other auxiliaries, will be about twenty-four pounds per kilowatt-hour for the compound sets, and 18.5 pounds for the 1,000-kilowatt sets. Al-

lowing for 1,000 kilowatts to be a standby, the total steam consumption will be 66,500 pounds for an output of 3,000 kilowatt-hours, an average of 22.2 pounds per kilowatt-hour.

To enable exhaust turbines to be used, the reciprocating plant would have to run under non-condensing conditions, that is to say, with the exhaust steam a few pounds above atmospheric pressure. The steam consumption at full load would then become about thirty-one pounds per kilowatt-hour for the small sets, and 24.5 pounds for the large set, or a total consumption of 86,500 pounds steam for the output of 3,000 kilowatt-hours, an average of 28.8 pounds per kilowatt-hour.

The condensation and other losses between the engine exhaust outlet and the exhaust turbine inlet will probably amount to ten per cent, so that there would be 77,850 pounds of exhaust steam to be utilized.

An exhaust turbine with a good vacuum will give one kilowatt-hour for about 37.5 pounds of steam, and therefore the extra capacity obtainable would be 2,076 kilowatt-hours, and the over-all steam consumption of the plant on a load of 5,076 kilowatts would be 17.0 pounds per kilowatt-hour. The result of adding exhaust turbines is, therefore, an increase of sixty-nine per cent in the capacity of the generating plant under condensing conditions, and a reduction in the steam consumption of 23.4 per cent.

In some cases the capacity of the reciprocating plant, if worked non-condensing, will be curtailed, but as the majority of the small plant in existing stations has been designed to give full outputs under such conditions, I do not make any allowance on this score.

It is as well to point out that, although the reduction on steam consumption on the prime-mover works out at 23.4 per cent, the actual saving in the fuel used per unit sold will be very much less, after making allowances for the constant losses in auxiliaries, condensation, and the extra power required to obtain the high vacuum; moreover, the probability is that some seventy to eighty per cent of the total output is already being supplied by the 1,000-kilowatt sets, having a consumption of 18.5 pounds per kilowatt-hour, so that the saving on the steam consumption of the remainder of the output consisting, largely of peak loads, will only be a percentage of a percentage.

The cost of installing two or more sets of exhaust turbine plant having a total capacity of 2,076 kilowatts, together with high vacuum pumps and condensers, will be $90,000 to $105,000. The same capacity of plant, including a single unit 2,076-kilowatt turbine set with its necessary complement of steam boilers, etc., could be provided for $110,000 to $125,000, and the steam consumption on one set of plant of this size would certainly be less than 17.0 pounds per kilowatt-hour.

These figures would appear to show that for public generating stations the circumstances would have to be exceptional to result in any ultimate advantage from installing exhaust or mixed-pressure turbines as compared with high-pressure turbines of equal capacity. In the latter case the first cost would be slightly more, but the steam consumption would be less. A very wide field, however, exists for the application of exhaust turbines for other purposes, such as collieries, rolling mills, shipyards, and other industries, particularly where large non-condensing engines are used. In many such cases the output could be increased 100 per cent with the same consumption of fuel, and electric motors supplied from the generator connected to the exhaust turbine could be substituted for the many small non-condensing engines usually required for other duties, and so effect a still further saving in the fuel consumption.

[To be continued.]

Brooklyn Section National Electric Light Association.

Frank W. Frueauff, of Denver, president of the National Electric Light Association, was the guest of honor at the meeting of Brooklyn Section, National Electric Light Association, that crowded the rooms of the Edison Club in the Johnston Building, on November 9.

Mr. Frueauff declared he had been greatly interested in listening to the reading of Julian N. Walton's paper on "The Storage Battery and Its Application to the Electric Vehicle." He agreed with Mr. Walton that in some respects the electric vehicle today is superior to all rivals.

Other papers on technical and commercial subjects followed that of Mr. Walton. Secretary Baily announced that there were then 294 members in the Brooklyn Company Section.

Gas Engines Drive Belgian Station.

The new generating station recently put into operation at the works of the Société Metallurgique du Hainaut, at Charleroe, in Belgium, includes two 1,250-horsepower gas engines.

Care of Storage Batteries.[1]

French industry in, at least, three important centers, Rouen, Lille and Mulhouse, is assisted and encouraged by technical and industrial societies. The last of these towns is in Alsace, but the industry is Gallic and the proceedings of the Mulhouse Society are still reported in French. Among the useful parts played by the Rouen Society is an arrangement by which its members can have the disinterested services of a first-class engineer, who is ready to give advice on the installation of machinery and steam power, and to make periodical visits of inspection or to advise on an emergency. An electrical engineer of high standing is also at the service of members.

The following information is taken from the report of this official, M. G. Thullier, for last year:

In addition to supervising the reception of new plant and assisting at several installations, he made twenty-eight emergency visits. These are charged at the modest rate of thirty-five francs per half day to the member of the society, and users of electricity in Rouen frequently become members of this excellent society in order to take advantage of this expert service. From the result of his observations, M. Thullier makes some interesting notes on the use and care of a battery of accumulators.

M. Thullier notes that the working capacity and durability of a battery of accumulators depends upon constant inspection of the battery and the regularity with which the charge of electricity is renewed each day, allowing for waste. It is well understood that a battery which has yielded 500 ampere-hours, for instance, should be charged with more than this amount, say, about 600 ampere-hours. In order to be able to charge a battery then, we must know how many ampere-hours it has given out since the last charging, if we are to save time and avoid hesitation and uncertainty in the operation. We must also know what proportion of the total output has been yielded. If the battery has been nearly exhausted, it must be recharged slowly, *i. e.*, with a comparatively weak current. In short, the attendant of the battery must keep a proper record, so that he may know each day what has been done with the battery the day before.

When the battery is charged the attendant tests the voltage, seeing with his volt-

[1] Abstracted from *The Electrical Engineer* (London, Eng.), September 10, 1909.

meter that it is about three volts, and ascertains by examining them one by one that none of the cells is short-circuited.

As in general the charging is done with a number of amperes sensibly constant, he has to increase the voltage as the charging proceeds, for the voltage at the limit of each cell ought to increase uniformly, except in the case of the reduction cells which have worked more or less.

As the charging proceeds, and as the voltage at the limits increases, the readings of the voltmeter enable us to see whether or not the separate cells are being equally charged. This is the most effectual kind of supervision and gives the best tests of the condition of the battery.

As the charging proceeds, the attendant, knowing exactly the number of cells in the circuit, and knowing that he ought not to exceed 2.65 volts per element, allowing for such as may be in a bad state, he ought to succeed in diminishing his amperage, bringing it almost to zero by the time the charging is finished, *i. e.*, when the voltage of the battery is equal to 2.65 multiplied by the number of cells. For example, if the battery is working with fifty-six cells, the charging is finished when the voltmeter shows $56 \times 2.65 = 148$ volts, and the amperage ought to be practically zero. At this moment the electrolyte should mark twenty-six degrees Beaumé, but this will not be the case unless each cell shows twenty-two degrees Beaumé at the commencement of the charging. This is, therefore, a very important point, and care should be taken that on charging the electrolyte has a density of twenty-two degrees Beaumé in each cell.

Finally, effervescence of the electrolyte is a sign that the charging is finished, but it may not occur. Again, a chocolate-brown color of the positive pole, contrasting with the matt gray of the negative pole, is another useful indication, but we must repeat that the readings of the voltmeter are the surest guide in this delicate part of the management of a battery.

We may sum up in the following rules: (1) Keep the electrolyte in all the cells at the same density, from twenty-two to twenty-six degrees Beaumé. (2) Never allow the voltage to fall below 1.8 per cell, nor the maximum number of amperes. (3) Never charge to above 2.65 volts per cell, nor the maximum number of amperes. (These two maxima should be fixed by the supplier of the battery and recorded in writing.) (4) Cut off the current when the battery is giving out more amperes than it is made to supply. This is a strong measure, but it is the only thing to do if the cells are to be kept in good order.

Electrical Opportunities in Mexico.

An American consul in Mexico reports that a company, composed largely of American citizens, and capitalized at $500,000, has secured a concession from the local government for developing a valuable waterpower in his district. The especial business of the company will be the owning, operating, and conducting of electric-power business, and the use of franchises, concessions, and contracts connected therewith. The work to be done consists of dam building and the establishment of the necessary machinery needed in an electrical plant, together with lines for the transmission of power. Everything that is to be used in an undertaking of this kind will be purchased, and manufacturers of the United States in the field for Mexican trade in the lines indicated would do well to investigate. Full information as to the needs of the company can be obtained from the president or the secretary, whose names and addresses may be obtained by writing to the Bureau of Manufactures, Washington, D. C., quoting File No. 4114.

An Enterprising Blacksmith.

A correspondent in Sheridan, Mont., states that Rudolph Flick, the local blacksmith of that burg, tired of waiting for a company to install electric light and power in the town, has put in a plant of his own. The power is derived from Mill Creek, which flows by his shop. A small ditch taken out above gives a ten-foot fall, sufficient to drive the wheel and dynamo and furnish power to light his residence and shop, and also a local department store. It is believed that by going about a mile further up the creek, says our correspondent, a plant can be put in for $5,000 sufficiently large to furnish power to light the entire town.

The Platinum Situation.

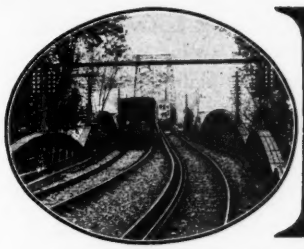
It is reported that the Russian producers of platinum are preparing to take measures which will result in a substantial increase in the price of platinum, which at present is from $27.00 to $27.75 an ounce for refined metal, and from $30.25 to $31.50 for hard metal. About ninety-five per cent of the world's supply of the metal comes from the mines in and around Nijni Taguil.

A New Crude-Oil Internal-Combustion Engine.

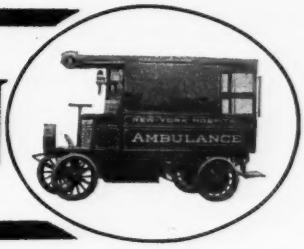
Consul Frank W. Mahin states (*Consular Report* No. 3612) that an engineering firm at Duffield, Derbyshire, England, has recently produced an engine, suitable for either marine or stationary purposes, which is designed to use heavy crude oils, such as cost in England six or seven cents a gallon. It is thus described by a writer for a technical periodical:

The engines, which are of twenty-five horsepower with two cylinders, and of fifty horsepower with four cylinders, run on the Otto cycle. The vaporizer is a feature of special interest. It is heated by the exhaust gases, and in it the oil, after having been preheated by passing through a jacket around the exhaust pipe, and having been atomized by compressed air, undergoes a process of fractional distillation. The portion of the oil that is of a lower flash point than about 220 degrees Fahrenheit is vaporized, and, meeting a current of air, which has also been preheated, is drawn into the cylinders; a certain amount of water is also injected, this having been found to improve the smoothness of running as well as to increase the power. The constituents of the oil that have a flash point above 220 degrees Fahrenheit and form the "hard base," are thrown against a collecting surface, whence they run down into a receiver as a thick, black, tarry liquid. This arrangement prevents the trouble which attends the use of heavy crude oils through the "hard base" entering and scoring the cylinders and clogging the valves. The governor regulates the supply of air and oil and the resulting vapor in such a way as to secure that the mixture admitted to the cylinders is correctly proportioned to the load on the engine; and by means of a hand lever, which can be locked in any position, it can be almost instantly set to give a speed variation of over fifty per cent. For starting, a spray of oil from the atomizer, worked from a reserve of oil and compressed air normally left in the tanks provided for the purpose, is lighted and directed upon the vaporizer, which in consequence is quickly heated, a few turns of the flywheel then sufficing to set the engine in motion.

In his inaugural address delivered on October 23 last, the president of the Staffordshire (Eng.) Iron and Steel Institute opined that the gas turbine would probably play an important part as a prime mover in the near future.



ELECTRIC TRACTION



ELECTRICALLY OPERATED COGWHEEL RAILWAY, MONTREUX-GLION, SWITZERLAND.

BY FRANK KOESTER.

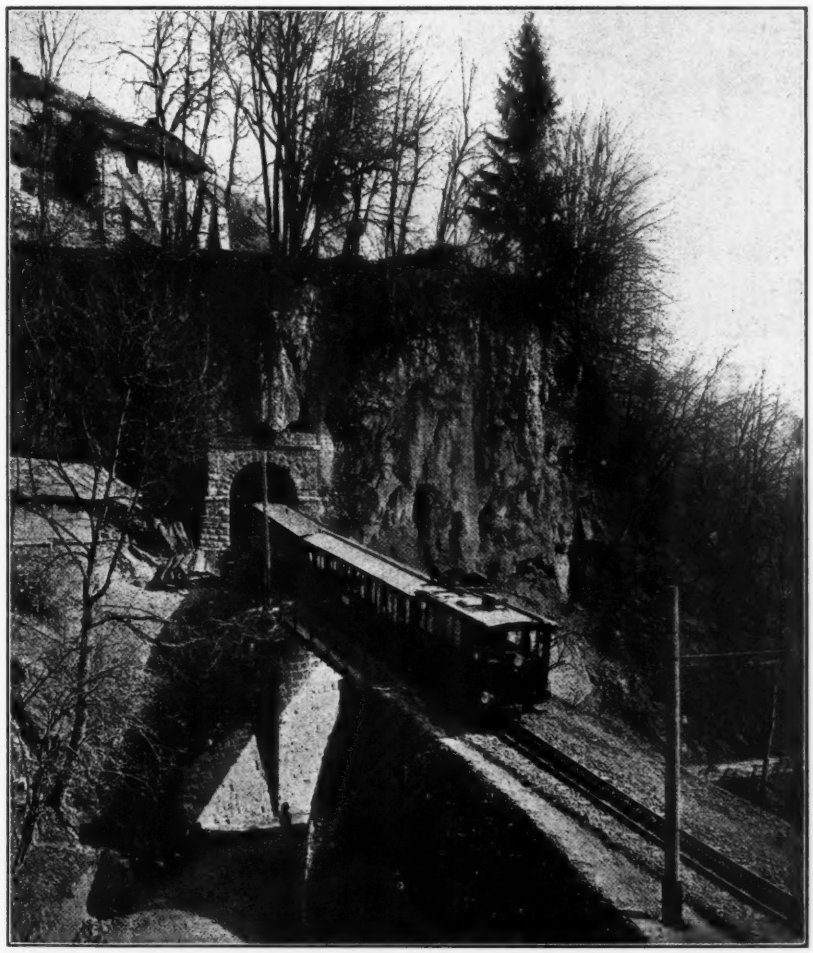
Glion, a town at the northeast end of Lake Geneva and much frequented by tourists, possessed one of the earliest inclined cable railways in Europe. In 1886 an electric trolley system was also installed having two conductors, for direct current, composed of slotted pipes. In 1892 a cogwheel road was also built running from Glion to Les Rochers de Naye. The railway described in this article is an extension of this cogwheel road and runs from Glion down to the main railway station at Montreux, which is a central point for tourists and the altitude of which is about 1,300 feet above sea level.

The total length of the new extension is 9,545 feet, of which the main portion, 8,800 feet, belongs to the cogwheel or rack section. The difference in altitude between the lowest and uppermost station is 964 feet, the average grade is 105 feet in 1,000, while the steepest grade is 130 in 1,000. A large portion of the road consists of tunnels, about one-third of which are on curves. The smallest radius of curves on tracks in the open is 262 feet, at stations 196 feet, and for switches as low as 164 feet, the average radius of all curves being 266 feet.

The gauge of the road is 31.5 inches to harmonize with the system previously operated. At the Montreux railway station an additional rail is provided to accommodate the Montreux Oberland Railway,[1] which makes connection at this station, and the gauge of which is 39.4 inches (one metre). This stretch is 1,237 feet long.

The station at Montreux is located partly within the first tunnel. After leaving this tunnel, which is on a level grade, a second tunnel is promptly reached that is 1,277 feet long and the steepest grade of which is 128 in 1,000. The substation is situated at the upper outlet of this tunnel and will be described later. Just beyond the second tunnel a structural steel bridge 200 feet in length spans the valley, crossing a stream, several streets and over the top of a building. The bottom chord of the truss is within three feet of the roof of this building. The grade over the bridge is 108 in 1,000. A station is situated just above the bridge, and, as the road is single-track, a turnout switch is provided here.

From here on the grades are steeper, being as much as 130 feet in 1,000. Entering the third tunnel, 274 feet in length, the road crosses under the above-mentioned cable road. After crossing a reinforced concrete bridge twenty-three feet long and passing through the fourth tunnel of eighty-five feet length the road soon enters another tunnel, the length of which is 1,266 feet. This tunnel forms a loop with a radius of 262 feet, a grade of 130 feet in 1,000, and forming three-quarters of a complete circle. The upper outlet of the tunnel is 164 feet above the lower. The remaining portion of the road runs over retaining walls along the slope of the mountain and before entering the terminal station at Glion, where connections are made with the Glion-Naye cogwheel road, which has been in operation since 1892, as mentioned above. This is also the terminus of the cable road spoken of. This station is 459 feet long, part of it lying along a four per cent grade, and the balance being level.



TYPICAL SCENE ON THE MONTREUX-GLION COGWHEEL RAILWAY IN SWITZERLAND.

The tunnels have a clear width of 12.5

[1] See article by B. F. Hirschauer in ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of February 6, 1909, page 249.

feet and are built with arched tops, the distance to the spring of which is fourteen feet above the rails. The lining of the tunnels is of concrete and brick. Drainage trenches are provided on one side of the tunnels.

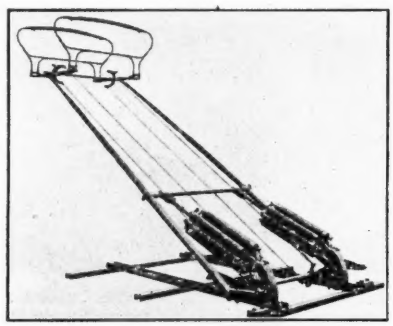
In the construction of this road many obstacles had to be overcome, as its course is under and alongside of buildings, such as restaurants, dwellings, schools, etc., and it was necessary to carry on the work without interfering with the use of these structures. As some of these buildings rest upon solid rock, no blasting was allowed.

The rails, 38.75 feet in length, are bolted to steel crossties 5.57 feet long, embedded in ballast and at intervals in concrete to prevent sliding. Rails of forty-five and fifty pounds to the yard are used. The racks are of the "Abt" type, similar to those of the Glion-Naye Railway, and are in sections of 5.9 feet in length, weighing sixty-six pounds per section. The normal pitch of the teeth is 4.75 inches and as the pitch diameter of the cogwheel is necessarily somewhat smaller than the diameter of the adhesion wheels on the truck axle, the pitch of the first few teeth at the entering end of the rack is somewhat less than the normal, being 4.25 inches. As will be seen later, the mechanism on the locomotive is so arranged that proper entrance of the cogwheel into the first teeth of the rack is brought about.

The racks consist of two toothed rails bolted on either side of the vertical member of an inverted T-iron in such manner that the teeth are staggered, thus necessitating a gear set consisting of two cogwheels. The advantage of this arrangement lies in the fact that a broken tooth on one rack will not interfere with proper operation, and furthermore the running is smoother than it would be with a single set of teeth.

Current at 8,000 volts, fifty cycles, is drawn from the power house at Montbovon and is stepped down and converted at a substation, located at the mouth of Tunnel No. 2, to 600-volt direct current. This substation may be run in parallel with the substation of the Montreux-Bernese Oberland Railway at Chernex. With this arrangement either of these stations may be a reserve for the other line. Each of these stations has a storage battery to further assist in case of emergencies.

Owing to the comparatively short length of the new road, two copper conductors of nine millimetres diameter are used. These are carried on the steel arms of wooden poles, the lower ends of which terminate above ground and are contained within channel irons which form footings



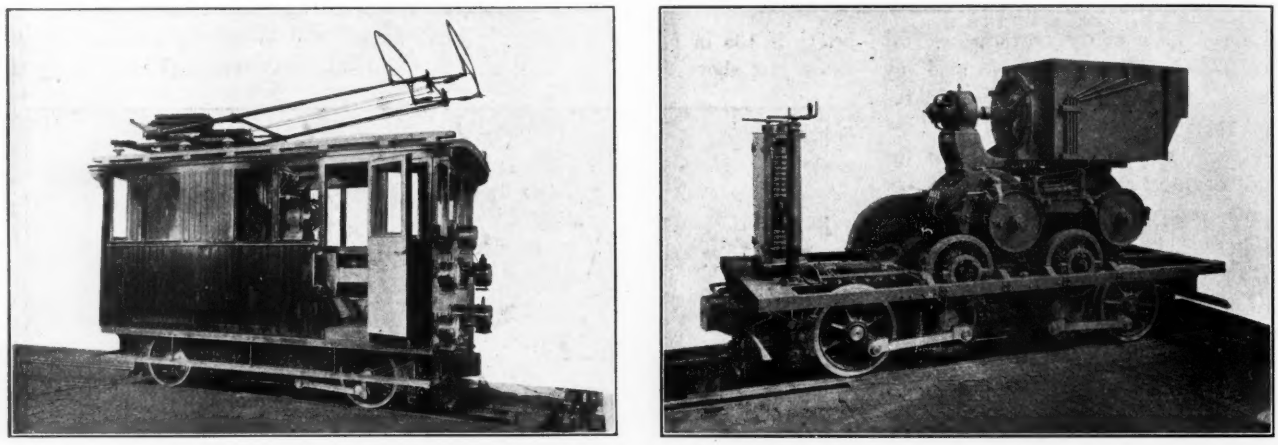
COLLECTOR BOWS.

sunk into the earth. At stations the conductors are twenty feet above the rails, while in the tunnels they are as low as thirteen feet and in open stretches the distance above rails is fourteen feet.

In order that the smoke from steam locomotives, which also run over these tracks, may not damage the conductors these are made of steel, instead of copper, at low points; and, for this same purpose, the conductors are swung out of center.

The rolling stock at present consists of three electric locomotives, four passenger cars, five flat and two box cars for freight and three smaller baggage cars. The locomotives are constructted to operate both as cogwheel or adhesion machines, the latter when on ordinary grades.

Each locomotive is equipped with two 110-horsepower motors geared by means of intermediate axle and gearing to the cogwheel axles, on the ends of which



VIEWS OF LOCOMOTIVE COMPLETE AND WITH BODY REMOVED, MONTREUX-GLION COGWHEEL LINE.

crank wheels are fitted which are connected to the truck axles by pitman rods, the two cogwheel axles being located between the truck axles. The front truck axle is also provided with a cogwheel, so that there are three cogwheel or pinion sets which mesh in the racks.

When running on the ordinary grade, where no rack is provided, the operation is as follows: Friction clutches are mounted on one end of each intermediate axle, the hub of the outer half of the clutch having rigidly attached to it a gear wheel which meshes with the gear teeth forming part of the crank wheel driving the truck axle upon which the rack pinions run loose. The inner member of the clutch is keyed to the intermediate axle and provided with three dogs engaging with the outer member in such manner as to allow a loose motion amounting to fully one-half of the pitch of the teeth of the rack. It will thus be seen that provision is made for the proper engagement of the teeth of the pinions with those of the rack when the locomotive reaches a steep grade or the beginning of the rack.

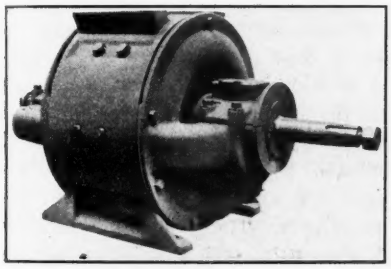
The two propelling motors are connected permanently in series, although there was taken into consideration that, if either motor should become inoperative,

the locomotive would be put entirely out of service.

The locomotives are equipped with brakes as follows: A hand brake operated by a crank simultaneously acting upon the cogwheel and truck axles; another hand brake acting upon the intermediate axle either by shoes or by a strap brake; an automatic brake acting by means of brake straps or bands direct on the motor shafts (this latter brake is automatically put into action when the speed exceeds thirteen to fourteen kilometres per hour, and is released by hand when necessary); an electrical short-circuiting brake is also provided for use in emergencies or in making the descent.

Special attention was given to the design of the controller in providing numerous steps, so that the speed regulation might be very gradual. For the purpose of cooling the rheostats, especially on the descent, a motor-driven ventilating fan is installed. This set and the box for the rheostats may be seen in the illustration mounted upon the motors.

The locomotives are provided further with lightning arresters, fuses, automatic



PROPULSION MOTOR, 110 HORSEPOWER.

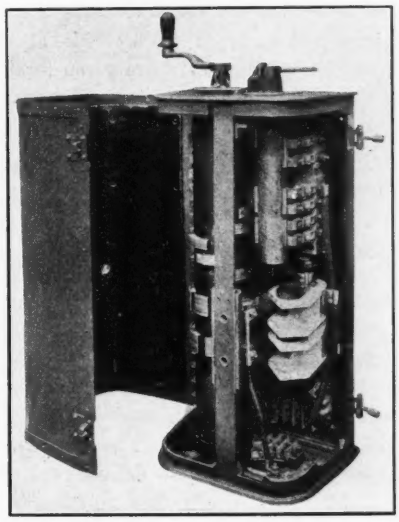
overload and underload circuit-breakers, a hand switch, a complete set of modern measuring instruments, speedometer and ground detector. The trains are equipped with electric heating, lighting and signal systems.

The total weight of each locomotive is 31,240 pounds, of which 12,012 pounds represents the electrical equipment. The latter was furnished by the Maschinenfabrik Oerlikon, Oerlikon, Switzerland, which company also supplied the entire electrical equipment for the overhead line construction, substations, etc.

The passenger cars are 6.5 feet wide over all and thirty-eight feet long, having a seating capacity of fifty-six. A passenger train is usually made up of two such cars. As these cars are also used on the steam road mentioned herein, they are equipped for lighting with storage batteries of 130-ampere-hour discharge capacity. The freight cars have a carrying capacity of ten metric tons. All cars, both passenger and freight, are provided with ordinary shoe brakes and also with a cogwheel brake similar to the one on the locomotive which are actuated by hand.

The maximum speed of a train going up a grade of 130 feet in 1,000, and having a total weight of about forty-five metric tons, is twelve kilometres (7.5 miles) per hour, while on the descent it is 6.25 miles allowable speed per hour.

It might be of interest to give a report of a test, under the supervision of the Swiss Federal Railway officials, of the automatic brake equipment. A train of 45.2 metric tons weight was running up a grade of 126 feet in 1,000 at a speed of nine kilometres (5.6 miles) per hour, when the current was suddenly cut off. It continued forward, due to its momentum, 5.7 feet during 2.8 seconds. It then



CONTROLLER.

started downward and after 5.2 seconds had acquired a speed of 8.1 miles and covered a distance downward of thirty-five feet. At this point the automatic brake became operative and within 3.6 seconds time and a distance of 27.8 feet the train came to a standstill. As, of course, the locomotive is always on the downward end of the train, and as the cars were not coupled to the locomotive during this test, it was noticed that the cars did not have any tendency to separate themselves from the locomotive owing to their lighter weight and lesser momentum than that of the locomotive. After inspection it was found that no portion of the locomotive equipment or of the rack was at all damaged.

The cost of the road per kilometre was 825,000 francs, or $264,000 per mile. It was opened to the public April 8, 1909.

Meeting of Central Electric Railway Association.

The regular bimonthly meeting of the Central Electric Railway Association was held in the Palm Room of the Claypool Hotel, Indianapolis, November 18. The attendance was above the average, many coming from Detroit and distant points in Ohio.

The meeting was called to order by the president, A. A. Anderson, general manager of the Indianapolis, Columbus & Southern Traction Company. After the reading of the minutes of the Detroit meeting by the secretary, A. L. Neeamer, President Anderson announced that the programme consisted largely of reports of committees and reviews of the work of the American Street and Interurban Railway Association's annual convention, held in Denver in October.

The standardization committee reported in favor of the adoption of a standard drawbar—one leading up to a universal automatic pocket. The committee thought the time was rapidly approaching when the law will demand an automatic coupler for interurban cars and suggested the advisability of preparing for it. The idea of the committee is to develop an M. C. B. coupler, and the committee asked that it be granted further time, since there are matters relating to the same subject being considered by the electric roads and the Indiana Railroad Commission.

The report was discussed freely, the speakers agreeing that it is necessary to do something to overcome the difficulty of coupling cars of different heights. Blue prints of an emergency coupler were exhibited. The committee was continued for further investigation and asked to report at the next meeting.

The committee on the carrying of the United States mail on interurban cars reported that it had been unable to obtain any satisfactory results from its labors with the Postoffice Department or Congress relative to an increased compensation for carrying the mail. The committee cited a number of mail routes that are now being served by the interurban roads at one-third the rate formerly paid to star route agents. In discussing the report the members of the association expressed some doubt as to whether a traction road could cancel its contract with the government.

The committee on publications made a report recommending that technical and trade journals should have a wider margin and should otherwise be improved so as to make binding of loose leaves more feasible,

the committee being continued and instructed to take the matter up with the publishers.

The first paper on the programme was read by J. G. Callen, electrical engineer, of Boston, Mass., on "A Centralized Testing Organization: Its Functions in the Management of Electric Railways." Mr. Callen said that the business of electric lines has become one of the largest developments of modern times. There are problems of great importance connected with the business, but none of more importance than that of ascertaining the cost of operation per car mile. Mr. Callen explained the advantages to be derived from the establishment of laboratories in which road material, lubrication, fuel, etc., may be tested. He said the buying of coal is important, in order to secure the quality that will give the best power and produce the least scale in the boilers. He said the best results are obtained by placing the whole matter in the hands of a fuel engineer.

Mr. Callen's paper was well received and a committee appointed to report on the suggestions relative to the advisability of establishing a test laboratory.

AFTERNOON SESSION.

The first paper of the afternoon session was read by A. D. B. Vanzandt, publicity agent, Detroit United Railway, Detroit, Mich.

Mr. Vanzandt's paper emphasized the point that the publicity department of a railroad is the connecting cog between the actual operating of the railway and the people through the press. It mentioned the two kinds of publicity, namely, advertising and news, and treated fully the distinction between the two. Beneficial methods of advertising were discussed and the various mediums classified according to their worth. In a like manner the news end of the publicity was treated and many valuable suggestions made.

This paper brought out a hearty discussion and a number of questions were satisfactorily answered by Mr. Vanzandt.

J. B. Crawford, superintendent Winona Interurban Railway, Warsaw, Ind., read an interesting paper reviewing the work accomplished by the Transportation and Traffic Association.

President Anderson announced that the remainder of the session would be devoted to a review of the work of the Denver convention and called on A. W. Brady, president of the Indiana Union Traction Company, who is an officer of the American Street and Interurban Railway Association. Mr. Brady said he had prepared no formal report, but said the convention was an unqualified success. The subjects were ably treated and heartily discussed. He praised the exhibits, the Denver electric lines and the citizens for the generous hospitality during the meeting.

E. C. Carpenter, claim adjuster, Indiana Union Traction Company, gave an interesting and instructive report of the work of the Claim Agents' Association, and reviewed the papers read and the incidents related on that subject before the Denver convention.

Mr. Carpenter's report incidentally brought out the question whether it is best to stop electric cars on the near or far crossing in cities. There was considerable division of opinion concerning this practice and apparently good argument in favor of both crossings.

The ladies attending the convention from Michigan, Ohio and Kentucky were taken in charge by those attending from Indiana and given a trolley ride at 2 o'clock. A theatre party was given to all the delegates remaining over Thursday night.

The next meeting will be held in Columbus, Ohio, January 28, 1910.

7,000 Steel Wheels Ordered.

Traction interests of Brooklyn have placed with the Carnegie Steel Company, of Pittsburg, orders for 7,000 steel wheels for electric cars, announcing that it is the intention to do away with the chilled iron wheels which have been used under the Brooklyn cars so long. The Carnegie company has promised to deliver part of the order within thirty days and the entire order before February 1.

It is estimated that 4,000 tons of steel will be required in making the wheels. Part of the former armor plate shops of the steel company at Homestead have been pressed into service as temporary shops for making wheels.

Central Bureau Formed for Traction Lines.

Representatives of the leading underwriters' associations of the country met in Boston recently and organized the Central Electric and Lighting Bureau which it is planned will handle the electric traction and lighting risks through the entire field. United States Manager E. G. Richards, of the North British and Mercantile Insurance Company, was elected president, and General Agent Cofran, of the Hartford Fire, at Chicago, was elected vice-president. The headquarters of the Bureau will probably be in New York city.

Electric Railroad in Carlsbad.

It is reported that an electric railroad may be constructed connecting the suburb of Fischern, where the railroad stations are located, with Carlsbad. This is a much-needed improvement, as the distance is more than a mile and the carriage charges are high. The greatest opposition to a complete electric-railway system, which would be a boon to the 270,000 annual visitors to this spa, comes from the hotel and lodging-house keepers, who are able under present conditions to charge extremely high prices for rooms. The congestion during the three months when the number of "cure guests" is at its height will be relieved somewhat next year, when one and possibly two large hotels will be built, equipped with modern conveniences. This will be appreciated especially by the Americans, who, to the number of 8,000, come to Carlsbad annually during the summer season.

Pennsylvania Tunnels Inspected.

Headed by President McCrea, officers and directors of the Pennsylvania Railroad made a trip of inspection through the company's Hudson and East River tunnels on November 18, on a special train of four cars which left Philadelphia at nine o'clock. Stops were made at all the points of interest, including the new uptown station and the Long Island terminals, and Vice-President Rea explained the underground system to the other officers. The company announces that the entire system will be open to traffic on June 1, 1910. Twenty-four electric locomotives, weighing each 330,000 pounds, will be used to handle the daily traffic.

New Cars on Broadway, New York City.

Pay-as-you-enter cars, slightly smaller than those now in use on the Madison Avenue line, were put in service recently on the Broadway and Amsterdam Avenue route, New York city. Similar cars will be gradually added to the Broadway-Columbus Avenue line, and it is expected that by December 1 both lines will be composed entirely of pay-as-you-enter cars. Fare boxes will not be a part of the equipment at first, but they will be added in about two weeks.

The merchants and gentry of Swatow, China, it is reported, say that as the business of the port is increasing they do not want to be behind the times, and so have subscribed $200,000 to establish an electric traction system in the city.

Damage by Electrolysis.

The municipal engineers of several American cities have been seeking information for the prevention of electrolytic damage to pipes and other metallic substructures. To this end E. N. Lake, chairman of the electrolysis subcommittee, Board of Supervising Engineers, Chicago Traction, of Chicago, submitted through the Bureau of Manufactures the following four questions for investigation by American consular officers in ten of the largest European cities:

The use of the track rails for the electrical return circuit of street-railway lines.

The permissible drop in potential over the return circuits of street-railway lines.

The maximum difference in potential between track rails used as return circuits and gas pipes, water pipes, or other metallic substructures contiguous to the track.

Regulations or practices with reference to electrically connecting track rails to gas mains, water pipes, or other metallic substructures.

Mr. Lake made a thorough study of the responsive consular reports, and furnishes the following résumé:

In answer to the first question, rails are used in all the cities named for return circuit. The summary of answers to the other questions follow:

City.	Permissible Drop in Potential Over Street-Railway Return Circuits.	Potential Difference Between Track Rails and Contiguous Pipes.	Electrical Connections Between Negative Return and Contiguous Pipes.
London	7 volts, maximum drop...	Pipes, +1.4 volts; pipes, —4.2 volts.	Permitted under special regulation.
Paris	1 volt per kilometre; 5 volts maximum.	Average of 1 volt normal operation.	No information.
Berlin	No specific regulation....	No specific regulation....	Not permitted.
Vienna	5 to 7 volts at maximum traffic.	Maximum observed, 1 volt.	None used.
St. Petersburg	1.5 volts maximum in city; 3 volts maximum in suburbs.	No regulation.....	Not permitted.
Moscow	Maximum 1.5 volts in city; 3 volts in country.	No regulation.....	Not used.
Glasgow	7 volts, maximum drop...	Maximum observed, less than 1 volt.	Permitted, but not practiced.
Liverpool	7 volts, maximum drop...	Maximum, 4.5 volts.....	None used.
Brussels	No specific regulation....	No specific regulation....	None used.
Christiania	Maximum drop about 10 volts.	Maximum about 5 volts..	No information.

The following additional notes taken from the letters and regulations received, while not bearing directly upon the four main queries, will be of interest in considering the general question of electrolysis.

London.—Return feeders may be uninsulated if laid within three feet of the track rails and electrically connected thereto at intervals of not more than 100 feet, otherwise they must be insulated unless they are of such sectional area that they will reduce the difference of potential between the ends of the uninsulated parts of the return below the maximum limit of seven volts.

If any part of the return circuit is uninsulated it must be connected with the negative terminal of the generator and the negative of the generator must also be grounded through an ammeter to two separate earth connections, one of which may be a water main.

Paris.—When electrical installations are in public highways or are for electric railways, applications for permits must contain complete information and specifications as to the proposed installation. These are passed upon by the several departments, and when permits are issued provision is made for close supervision of the governmental department interested. A three-wire system at 1,200 volts between trolley wires may be used, provided the track rails are used as the neutral conductor. The resistance of a rail joint, where the tracks are used for return circuit, must not be greater than the resistance of ten metres (32.8 feet) of unjointed rail.

Berlin.—Grounding of rails to earth or to pipes is not permitted, and artificial earth plates are prohibited. The city exercises a supervision over the matter of potential differences in the earth through the jurisdiction of the city official engineers. No specific potential differences or potential drops are mentioned in the requirements, but power is reserved by the city to investigate and prescribe in accordance with the conditions applying to each individual case.

Vienna.—The license regulations of the Austrian railway ministry provide for supervision of the return circuit conditions in a manner similar to that noted with reference to Berlin, except that in Vienna there is a municipal street-railway system. A periodical examination is made by means of a test car of the electrical condition of track joints and return circuits.

St. Petersburg.—Maximum potential drop in return circuits was originally specified as five volts per verst in suburbs and two-and-one-half volts in city. This is equal to about 7.5 volts and three-and-three-quarter volts per mile, respectively. This is now three volts and one-and-one-half volts maximum between any two points on the system.

Moscow.—Equalizing rheostats are used in the negative return cables. Underground pipe systems are divided into sections by insulating joints.

Glasgow.—The Glasgow authorities consider the board of trade regulation of seven volts maximum drop between any two points of the return circuit as far too high and have limited their drop to two and three volts. The lead sheaths of their own cables are connected by the tramway department to the track rails at every manhole or at an average interval of about 350 feet.

Liverpool.—Board of trade regulations apply and are the same as in London.

Brussels.—There is only a general regulation without specific requirements as to potential differences or drops, which provides that the electrical conductivity of the return shall be such as to avoid all harmful "electrolytic actions."

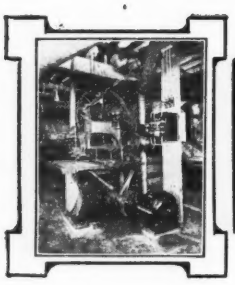
Christiania.—In addition to the bonded rails for the return circuit an auxiliary copper conductor, about No. 8 B. & S. gauge, is soldered to the bonds at each rail joint.

Construction of a Street Railway.

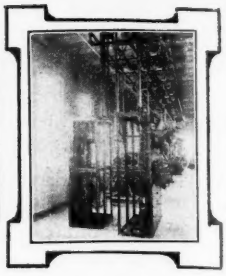
A franchise for the construction and operation of a street railway in a city of Latin America has been granted by the municipal governmment to two residents of the city. The franchise calls for either single or double track and the use of any kind of power, and the railway is to run through the principal streets of the city and about a mile beyond the municipal limits. The consul submitting the report states that the concessionaires have interested capital from the United States in the enterprise. Further particulars may be had by addressing the Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C., and referring to file No. 4117.

New Automatic Railroad Station Announcer.

Consul-General Richard Guenther, of Frankfort, reports that a new automatic station announcer is about to be tested on the Prussian state railways, with a view to its adoption. The apparatus, which is of the size of an ordinary cigar box, is easily installed in each car and compartment. All of them are connected with the baggage car, from where the device is operated. By closing of a contact all the announcers respond at once and make the name of the next station appear.



Industrial Power



Electrical Propulsion of Ships.

There have been many attempts to apply batteries to the propulsion of boats, but these experiments have nowhere resulted in lasting commercial results; the prospects of seeing a large ship laboriously hauling an acre or two of batteries through the surf was almost too much to expect, and although many attempts have been made from time to time, it remained for the introduction of high-speed and efficient prime-movers, such as internal-combustion engines and steam turbines, together with the tremendous advance in the art of designing and building dynamo-electric machinery, before the application of the electric motor could be reasonably put forward as a means of propeller-shaft driving for main marine work.

An important step in this direction took place in 1903, at St. Petersburg, when a vessel was constructed and put into service by the firm of Nobel Brothers. In this craft was a tank vessel of 1,150 tons displacement, intended to carry oil on the Volga and in the Caspian Sea. The propulsive plant of this interesting vessel consisted of three Diesel engines, driving three direct-current motors, each serving to drive one of the three propellers, the control for which being carried out from the bridge. The regulation was effected by means of varying the exciting current of both the generators and also the motors, by which means also the reversing of the propellers was carried out. The vessel speed was, however, only very low; when light, eight knots, and when loaded, 7.4 knots; the total power of the engines was 360 brake-horsepower, 120 horsepower each. The generating plant was situated about amidships, while the motors were placed right aft in a separate motor room. The control being arranged from the bridge, the engine-room staff did not know in what direction the propellers were running, while the staff in the motor room, knowing it, were unable to bring about any change. The complete control of the drive was carried out by the engineer on the bridge, and he steered and maneuvered the ship without having any contact with the engine-room staff.

As stated before, the advent of the internal-combustion engine and the high-speed steam turbine has brought about conditions which now make the commercial possibilities of the electric motor for main marine propulsion appear well within sight, and some very interesting suggestions have during the last few years been made as to its application to such very important work and exacting conditions; in America and on the Continent of Europe some of the most important members of the engineering world have been at work on this subject.

Some hesitation may at first be apparent as to the reason for introducing electricity between the prime-mover and the propeller, to which point we all wish to apply the power of the prime-mover with the least possible of losses; and, on the face of the matter, it certainly does appear that if compared with the existing slow-running marine engines, with their slow-running propellers, etc., under those circumstances, the application of electricity, or any other intermediate, would be a wasteful and unnecessary, if not a ridiculous, idea.

But as the march of science goes on we find that prime-movers are introduced (such as steam turbines, etc.), which, to be economical in fuel, must be run at such revolution speed—many times that of the efficient propeller—in order that it may produce the utmost thrust per horsepower delivered to it. As you all know, the modern reciprocating-engined cargo boats have propeller speeds of from sixty to 120 revolutions per minute, and work with great comparative economy as compared with steamers that have been fitted with steam turbines. In some cases the propellers have been raised in speed to meet the high speed of the turbine. It is a well-known fact that the steam turbine to be economical in fuel must be run at a high blade speed and be supplied with dry or superheated steam, and must be run also on a high vacuum; on the other hand, the propeller is a piece of mechanical machinery that to be efficient must be run at low speed, so that it becomes very evident that direct-coupled turbines mean for main marine propulsion a compromise of a very wasteful nature, *i. e.*, the turbines are brought down in revolution speed, and the propellers are correspondingly raised in revolution speed. The consequence is that the propeller cannot produce the maximum of thrust, and the turbine cannot produce the utmost amount of horsepower from a given amount of steam or fuel burnt, as compared with what is possible if some such reduction gear, such as electrical power transmission, is introduced between the high-speed steam turbine and the comparatively slow-speed propeller that could then be used. As an example, take the *Lusitania*. The trial figures show that the propulsive efficiency worked out at about forty-eight per cent—this with the turbines and propellers running at 186 revolutions per minute—and the power was about 16,375 horsepower in each of four shafts. Now Doctor Caird asserts that had the *Lusitania* been fitted with slow-speed reciprocating engines with the propellers only running at eighty revolutions per minute, and, of course, larger in diameter than those used at present, that the power required by the propellers for the same vessel speed of twenty-five knots would only have been 52,830 horsepower, or only 13,207 horsepower on each shaft, and that the propulsion efficiency for the above power would be about sixty per cent instead of forty-eight per cent; so you see what the running of the propellers at slow speed means, as it is not the fact that it is essential that the reciprocating engine is more economical than the turbine, but the fact rather of running the propeller at a comparatively low speed, making large blades and low pressures per square inch of propeller blade possible, and consequently taking better grip of the water, thus producing the maximum of thrust per unit of power.

[1] Abstract of a paper read before the London (Eng.) Association of Foreman Engineers and Draftsmen, by William P. Durtnall, September 4, 1909.

It will thus be seen that if electric motors are coupled to slow-speed propellers, the same propulsive efficiency may be obtained per horsepower delivered by the motor shaft to the propeller shaft.

Now we will come to the matter of steam consumption, and we will leave the matter of auxiliary driving out, so as to get the proper comparison for the fuel burnt per horsepower for propulsion only in each case.

The figures stated in the trials of the above vessel go to show that the amount of steam per shaft-horsepower was 12.77 pounds per hour, therefore requiring 836,435 pounds of steam (this for propulsion only). Now if the propellers were driven by induction motors (say, two 8,188 horsepower each) on each shaft, these motors can be made with a mechanical efficiency of, say, ninety-three per cent, which to supply them with sufficient electrical energy to do this work of 16,375 horsepower on each shaft would require, say, 52,403 kilowatts (leaving out the small amount of loss that would, of course, take place between the generators and the motors). To meet the above conditions, we will assume to put on board five 10,480-kilowatt turbine alternators running at 1,000 revolutions per minute, and these, when supplied with steam at, say, 160 pounds pressure, superheated by 100 degrees Fahrenheit, and running on a vacuum of twenty-eight inches (which can under these circumstances be obtained at sea in the Atlantic, but, of course, not in the Red Sea), the guaranteed steam consumption can be eleven pounds per kilowatt-hour delivered to the terminals of the generators. This means that 576,433 pounds of steam per hour would be used for propulsion only, which is a saving of no less than thirty-one per cent in steam and (therefore) fuel, that is, taking the speed of the propellers and motors as at present, namely, 185 revolutions per minute. A further reduction in the power required, and, therefore, fuel, is quite possible, insomuch that it is quite within the range of practical possibility to build motors of this size that would run with economy at, say, 150 revolutions per minute, and at the same time to be of such diameter that they would get into the narrow after-lines of the vessel, at least in the same places as the present space occupied by the present turbines. It must be remembered that I do not propose to use motors with a lot of different windings on them to be able to change the revolution speed, as this is done in my "Paragon" system by means of the generation current at various periodicities. This in turn allows the motors to run at such a speed which may be desired in practice, with the consequent absence of complicated controllers and without the necessity of wasteful resistances, etc.; so it will be very evident to you that the power transmission efficiency will be the highest possible electrically.

I will leave to your own imagination what this tremendous saving in fuel will mean, and the following items will be at least reduced by a like amount: Boilers, stokers, trimmers, feed pumps, draft fans, funneling, coal bunkerage, dead water in boilers, smaller steam and exhaust pipes, condensers and their circulating water, pumps of all kinds, and many other things that make up the steam plant of a modern liner.

Ship owners will be well advised to look right into this matter, and I am of an opinion that the coming competition in the shipping trade will compel the shipbuilders to employ high-speed superheated-steam turbines to produce the power, and to adopt electrical means to transmit the same to slow-speed propellers, for the above reasons; and when this is done, such low coal consumption per ton of displacement per mile at any given vessel speed will then be recorded that it will be a most difficult thing for shipping firms to exist commercially without it.

There is another prime mover that is now making very rapid headway to the front, *i. e.*, the internal-combustion engine, with its light weight and high thermal efficiency, and this in the next decade will be extensively adopted for propelling ships and also for working auxiliary machinery on the same, in conjunction with electrical power transmission. These interesting prime-movers will show further economies, especially in those vessels that only require power up to, say, 1,000 shaft-horsepower. At present, above that power, the high-speed superheated-steam turbine is top dog as regards its practical application, inasmuch as the reversing and speed regulation can be carried out electrically, so that the engines may run at high speed (much above that of the propeller) always in the same direction, and at constant speed rotation, irrespective of the speed of the propeller, or whether the vessel is going "ahead" or "astern," and this control can be very efficiently brought about either from the engine room or from the bridge.

Standardization of Machine-Tool Motors.

At the eighth annual convention of the National Machine Tool Builders' Association, held in New York last month, a preliminary report was presented by a committee appointed about a year ago to consider the standardizing of electric motors for machine tools. This report covered the results obtained from a meeting held about the first of the year with the American Association of Motor Manufacturers, which body is also endeavoring to evolve a standard type of motor especially adapted to the particular requirements of machine tools.

Specific questions were asked in a circular letter sent out under date of September 14 to the members of the association, replies being received from about one-third of them. To only one of the questions asked was a unanimous reply received, the motor manufacturers affirming that it would be beneficial to make the dimensions of the base and of other important parts conform to a standard for motors of a given horsepower. Replies to other questions on tolerances, maximum speeds of motors, peripheral speeds of gears, etc., showed no such uniformity. Eighty-four per cent were in favor of tolerances, while the remaining sixteen per cent preferred exact dimensions. Regarding the question of maximum speeds, the majority of the replies favored a speed of 1,200 revolutions a minute for the smaller motors, say up to five horsepower. Other replies on this and other questions showed a great diversity of opinion.

Austro-German Waterpower Dispute.

A new difficulty has arisen in recent months in connection with the proposals for the utilization of waterpowers in Bavaria for state and private purposes, says *The Electrical Review*, of London, Eng., in consequence of differences of opinion between Bavaria and Austria in regard to sovereign rights and obligations in respect of the adjoining territory.

Austria claims the right of artificially diverting waters rising in Austria and flowing over into Bavaria, but the latter country disputes the possession of the right. If the dispute were a theoretical one the solution could be left for the distant future to solve. But Austria seems to make the supply district of the Chiemsee a serious matter, and to desire to withdraw about one-third of the waterpower of the Alz. So long as this danger threatens it is considered that no industrial undertaking will be willing to as-

sume a concession for the use of water-power in the country.

The Badische Anilin und Sodafabrik has for years been seeking a concession for the erection of nitrogen works by the use of a portion of the fall of the Alz, which is the second largest waterpower in Germany. The Government made inquiries of manufacturers as to their prospective demands for power, but these were unsatisfactory, and it then seemed as if the Baden company's application would be granted. In the meantime the dispute has arisen with Austria, and although the subject was discussed several months ago in Vienna between representatives of both governments, no progress was made towards a settlement.

It is believed that Prussia is also interested in the question, although to a less extent than Bavaria, and the hope is expressed in the latter country that Austria will consent to have the problem referred to the Hague Court of Arbitration for decision.

Electric Drive in Textile Mills.

One of the regular correspondents of *The Electrical Engineer,* of London, Eng., writes in a recent issue of that paper as follows:

"A good answer to those who are against electric driving is that all firms giving it a trial in one or two rooms, adopt it all through their mills and for new extensions. I have interviewed a spinner who installed the electric drive in a new mill some time ago. He was so satisfied with the results that he employed it in a second mill as well, making such minor improvements as he had found desirable. This gentleman, who is a mechanical engineer as well as a spinner, was surprised that other spinners, knowing the details of their business so well, were blind to the advantages of the electric drive. I learned that the cost per horsepower for electricity generated on the spot, and for steam driving was about the same; also the cost of plant in the first instance was similar.

"His first mill had two high-speed turbines, but he had found them so satisfactory and reliable that if he were redesigning he would instal one large unit instead of splitting the load, as experience showed that there was no more likelihood of a generator and turbine going wrong than there was of an ordinary mill engine—and no one would think of installing spares in the latter case. The constant working speed produced a finer and more even thread than is got by steam driving direct, and this finer yarn gives the firm a better position in the market and enables it to secure orders in preference to other spinners.

"Another point worthy of notice was that the starting load on Monday morning in the case of the electric drive was only 6.5 to 7.0 per cent in excess of Saturday morning's. In the steam drive there are many cases where the Monday morning load is as much as 200 horsepower above normal in a total of 1,300 horsepower. As the electric drive is fifty per cent faster than steam, much cheaper and lighter belts are used, and this all reduces the losses. His shafts were direct-driven from one end by motors. It was his opinion that electric driving was the only way to modernize old mills, and that for new mills even, it possessed distinct advantages."

Electricity from Ocean Waves.

A Victoria (Australia) inventor of a wave engine proposes to build a pier at Sorrento, a town in that state, for a fifty-horsepower installation which will be utilized to generate electricity for use by the municipality. The power is to be obtained from the rising and falling with the waves of a free buoy, the movement of which will be converted into rotary motion for driving a dynamo. There is no record to hand of any similar application of wave motors being put in practice.

Electrical Standardization in Canada.

At a recent conference of municipal engineers in Toronto, Canada, the standardization of equipment for municipal hydroelectric undertakings was considered in some detail. It was decided, among other things, that no motor exceeding ten horsepower in rated capacity shall be supplied with power from electric-light mains.

The World's Production of Calcium Carbide.

Up to the present time waterpower stations of about 360,000 horsepower have been built for the manufacture of calcium carbide. Scandinavia, Switzerland, the United States and Canada each employs from 52,000 to 70,000 horsepower for this purpose; Italy, 46,000; France, 35,000, and Spain, 20,000. The carbide factories of Germany use only 9,700 horsepower, and those of Great Britain still less. A 25,000-horsepower plant being erected in Scotland has not been taken into account in these figures. There are small establishments in the Argentine Republic and in Japan. All of these installations are capable of producing 300,000 tons of carbide a year; but the present consumption does not yet reach 200,000 tons, and the works are therefore utilized only to about two-thirds of their capacity; Germany produces only about one-quarter of its consumption; Great Britain, one-eleventh. Norway, on the other hand, consumes only a small part of its production, and exported about 37,000 tons in 1908. With some installations recently completed, Norway is capable of producing 80,000 to 90,000 tons of calcium carbide a year, which is nearly one-half of the present world consumption.—*Translated and abstracted from Journal fuer Gasbeleuchtung (Munich), October 23.*

Copper Production for October.

The copper production for the month of October was given as 124,657,709 pounds by the Copper Producers' Association, as compared with 118,023,139 pounds in September. The total consumption as indicated by deliveries for domestic use and export, was 122,620,855 pounds, against 102,188,932 pounds delivered in September. This increase in the sales of copper reduced the total added to stocks 2,036,854 pounds, making the total stocks on hand on the first of this month 153,509,626 pounds.

In some quarters a small decrease in stocks had been expected in view of the large buying of the last month, but disappointment over the increase shown was tempered by the fact that the domestic deliveries during the month totaled 66,339,617 pounds, against 52,105,155 for September, a gain of 14,254,462 pounds. The deliveries for export, 56,509,626 pounds, were also large, comparing with 50,077,777 in September.

Multiplex Wireless.

According to the *Post Office Electrical Engineers' Journal,* an invention has just been patented in Berlin by F. van der Wonde which has for its object the adaptation of wireless telegraphy to multiplex working. The antenna is joined to a spiral device carrying a number of contact arms, which, when revolved, makes the following connections: (1) Transmitter joined up; (2) antenna earthed; (3) transmitter cut out; (4) receiver joined up; (5) earth disconnected; (6) receiver cut out. The speed of action is such that several revolutions take place during the time necessary for the sending of a Morse dot.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

CHICAGO RAILWAYS.

The report of the Chicago Railways Company for the month of September and eight months ended September 30, 1909, compares as follows:

	1909.	1908.
September gross	$1,066,056	$ 960,568
Expenses and taxes	718,855	789,462
Balance	$ 347,201	$ 171,106
Thirty per cent of gross	319,816	288,170
Interest on property, 5 per cent	198,324	146,448
Net earnings	$ 121,492	$ 141,722
City's share, 55 per cent	66,820	77,946
Company's share, 45 per cent	54,671	63,774
Eight months gross earnings		$8,188,754
Expenses and taxes		5,429,890
Balance		$2,758,865
Thirty per cent of gross		2,456,625
Five per cent interest on valuation of property		1,437,482
Net income		$1,019,143
City's share, 55 per cent		560,528
Company's share, 45 per cent		458,614

HOLYOKE STREET RAILWAY COMPANY.

The annual report of the Holyoke (Mass.) Street Railway Company has been issued for the year ended September 30, 1909. The income account compares as follows:

	1909.	1908
Gross	$488,919	$467,545
Operating expenses	263,549	311,066
Net earnings	$255,370	$156,479
Interest, taxes, etc.	123,618	109,134
Balance for dividends	†$ 96,752	$ 47,345
Dividends	85,888	82,144
Surplus	$ 10,864	*$ 34,799

*Deficit. †Equal to 9.01 per cent earned on $1,073,600 capital stock, as compared with 4.4 per cent earned on same capital stock in previous year.

WORCESTER CONSOLIDATED STREET RAILWAY COMPANY.

The annual report of the Worcester (Mass.) Consolidated Street Railway Company for the year ended September 30, 1909, compares as follows:

	1909.	1908.
Gross	$1,702,657	$1,626,143
Expenses	1,065,162	1,045,293
Net	$ 637,495	$ 580,850
Charges	394,156	375,722
Surplus	*$ 243,339	$ 205,128
Dividends	213,000	195,250
Surplus	$ 30,338	$ 9,878

*Equal to 6.85 per cent on $3,550,000 outstanding capital stock.

SPRINGFIELD STREET RAILWAY COMPANY.

The annual report of the Springfield (Mass.) Street Railway Company for the year ended September 30, 1909, compares as follows:

	1909.	1908.
Gross	$1,411,808	$1,317,138
Expenses	959,775	875,647
Net	$ 452,033	$ 441,491
Interest and taxes	261,526	255,801
Surplus	*$ 190,507	$ 185,690
Dividends	180,648	180,648
Surplus	$ 9,859	$ 5,042

*Equal to 8.43 per cent earned on $2,258,100 capital stock as compared with 8.22 per cent earned on same capital stock in previous year.

EMPIRE CITY SUBWAY COMPANY.

The New York Public Service Commission has issued a report covering the operations of the Empire City Subway Company, Limited, for the year ended December 31, 1908, as follows:

Subway rentals	$1,148,622
Miscellaneous revenue	8,741
Total revenue	$1,157,363
Operating expenses and taxes	522,359
Net income	$ 635,004
Other income	19,410
Total income	$ 654,414
Interest on funded debt	409,440
Net corporate income	$ 244,974
Surplus December 31, 1907	4,968
Total	$ 249,943
Dividends (5¾ per cent on $4,324,000 stock)	248,630
Surplus December 31, 1908	$ 1,313

KEYSTONE TELEPHONE COMPANY.

The report of the Keystone Telephone Company for the month of October and four months ended October 31, 1909, compares as follows:

	1909.	1908.
October gross	$ 91,560	$ 88,819
Expenses and taxes	45,544	43,420
October net	$ 46,016	$ 45,399
Charges, etc.	32,768	34,482
October surplus	$ 13,248	$ 10,917
Four months gross	364,411	351,006
Expenses and taxes	181,067	174,754
Four months net	$183,344	$176,252
Charges, etc.	134,596	138,166
Four months surplus	$ 48,748	$ 38,086

BERKSHIRE STREET RAILWAY COMPANY.

The annual report of the Berkshire (Mass.) Street Railway Company has been issued. The income account for the year ended September 30, 1909, compares as follows:

	1909.	1908.
Gross	$435,143	$406,150
Operating expenses	287,401	295,434
Net	$147,742	$110,716
Interest, taxes, etc.	113,032	109,439
Surplus	*$ 34,710	$ 1,277

*Equal to earning 2.1 per cent on $1,648,100 capital stock outstanding.

OLD COLONY STREET RAILWAY COMPANY.

The Old Colony Street Railway Company, of Boston, has issued its income account for the year ended September 30, 1909, which compares as follows:

	1909.	1908.
Gross	$2,934,281	$2,806,708
Operating expenses	1,847,859	1,821,451
Net	$1,086,422	$ 985,257
Other income	134,682	128,890
Total income	$1,221,104	$1,114,147
Changes	715,956	731,033
Balance for dividends	*$ 505,146	$ 383,114
Dividends	400,079	308,488
Surplus	$ 105,067	$ 74,626

*Equal to 6.2 per cent earned on $7,712,200 common stock, after deducting for a full dividend on $372,600 preferred 6 per cent cumulative stock.

AMERICAN LIGHT AND TRACTION.

The report of the American Light and Traction Company for the month of October and ten months ended October 31 compares as follows:

	1909.	1908.
October gross	$ 313,847	$ 278,220
Expenses	8,865	4,000
October net	$ 304,982	$ 274,220
Ten months gross	2,619,969	2,130,026
Expenses	88,055	40,000
Ten months net	$2,531,914	$2,090,026

CONSOLIDATED TELEGRAPH AND ELECTRICAL SUBWAY.

The New York Public Service Commission has issued a report covering the operations of the Consolidated Telegraph and Electrical Subway Company, for the year ended December 31, 1908, as follows:

Subway rentals	$1,000,560
Miscellaneous revenue	12,902
Total revenue	$1,013,462
Operating expenses and taxes	267,110
Net	$ 746,351
Other income	23,728
Total income	$ 770,079
Charges	677,281
Net corporate income	$ 92,798
Deficit December 31, 1907	28,424
Surplus December 31, 1908	$ 64,373

FORT WAYNE & WABASH VALLEY.

The report of the Fort Wayne & Wabash Valley Traction Company for the month of September and nine months ended September 30, 1909, compares as follows:

	1909.	1908.
September gross	$ 132,736	$ 122,442
Expenses	71,064	60,973
September net	$ 61,672	$ 61,469
Nine months gross	1,038,350	978,700
Expenses	608,539	553,469
Nine months net	$ 429,811	$ 425,231

KINGS COUNTY ELECTRIC LIGHT AND POWER.

The New York Public Service Commission has issued a report covering the operations of the Kings County Electric Light and Power Company, of Brooklyn, for the year ended December 31, 1908, as follows:

Non-operating income:	
Rents accrued from lease of electric plant and equipment	$ 777,533
Interest on bonds	46,520
Interest on securities, loans, etc.	2,308
Net corporate income	$ 826,361
Previous surplus	1,181,213
Total sprplus	$2,007,574
Dividends	800,000
Surplus December 31, 1908	$1,207,574

BOSTON & WORCESTER ELECTRIC REPORT.

The Boston & Worcester Electric Company's income account for the year ended September 30, 1909, compares as follows:

	1909.	1908.
Total income	†$96,505	$141,663
Surplus after dividends, etc.	*8,543	614
Previous surplus	4,753	.....
Total	$13,296	.....
Discount on notes	9,000	.....
Surplus September 30, 1909	$ 4,296	.....

*Increase of $7,929. †Decrease of $45,156.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

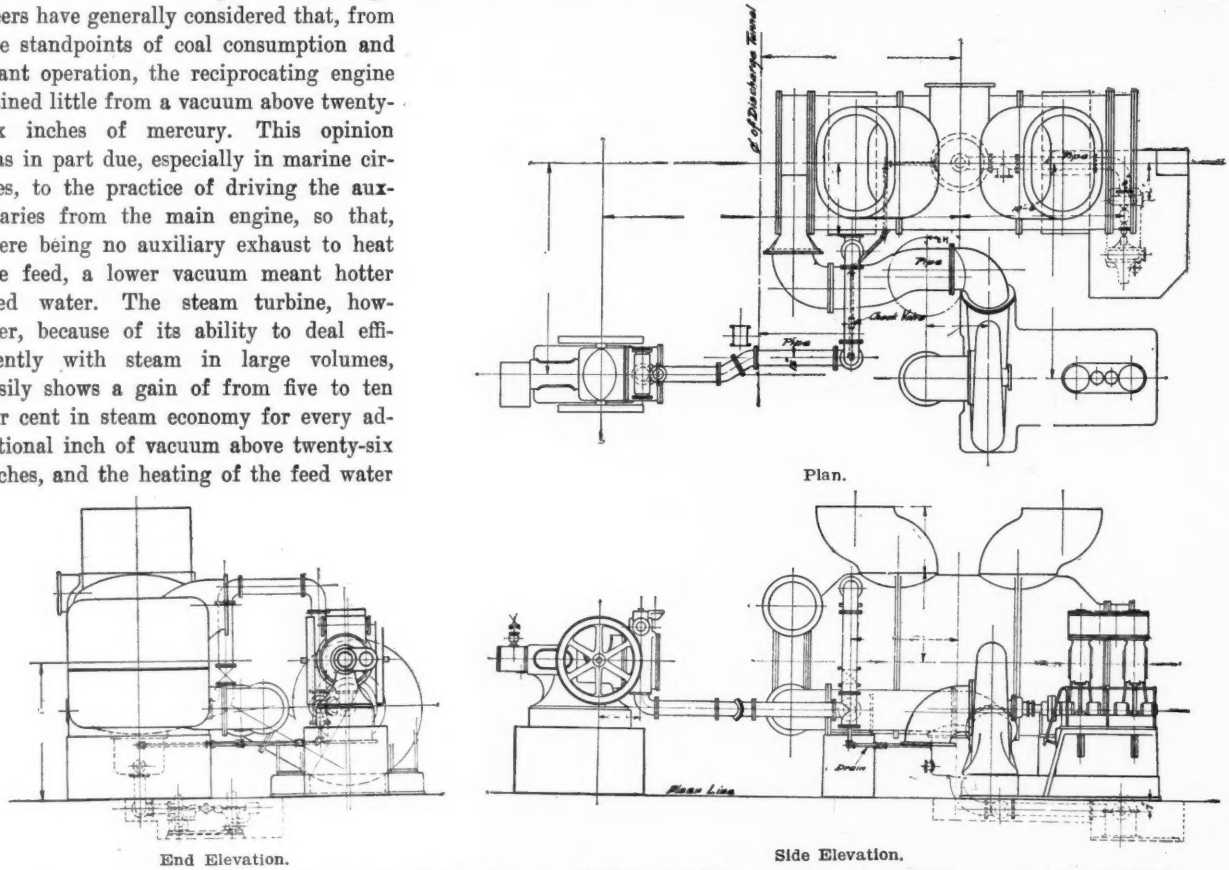
Modern Condenser Design; a Good Example and a Remarkable Test Result.

Some ten or fifteen years ago the designing and proportioning of surface condensers crystallized into a more or less standard practice, but the steam turbine, by its ability to make use of steam at low pressures and temperatures, or by its requirement of a high vacuum, has forced the question of condenser efficiency again to the front. In the past, steam engineers have generally considered that, from the standpoints of coal consumption and plant operation, the reciprocating engine gained little from a vacuum above twenty-six inches of mercury. This opinion was in part due, especially in marine circles, to the practice of driving the auxiliaries from the main engine, so that, there being no auxiliary exhaust to heat the feed, a lower vacuum meant hotter feed water. The steam turbine, however, because of its ability to deal efficiently with steam in large volumes, easily shows a gain of from five to ten per cent in steam economy for every additional inch of vacuum above twenty-six inches, and the heating of the feed water is properly left to the economizers or to heaters utilizing the exhaust of auxiliaries.

The activity of the several groups of tubes in a surface condenser can be quite accurately inferred from the rise in temperature of the water passing through them. By inserting thermometers in the water boxes it has thus been discovered that in the ordinary surface condenser most of the heat is absorbed—that is, most of the steam is condensed in the first few rows at the top. This at once suggested the possibility of a rearrangement of the tubes, so that more of them would approach the high efficiency of the top rows.

The transmission of heat through condenser tube surface may be affected by the following conditions, among others: (1) Whether or not the tube is flooded by water descending from the tubes above. (2) The velocity of water through the tube. (3) The velocity of steam against the tube. (4) Whether or not the tube is immersed in an atmosphere of air. (5) The material, thickness and cleanliness of the tube.

While much scientific investigation has been devoted to the effects of water velocity and of steam velocity, the possibilities of improvement in this direction are limited by the fact that excessively high steam velocities involve back pressure on the prime mover, while very high water velocities involve the consumption of an excessive amount of power in the circulating pumps. According to reliable experimenters, the heat transmission increases only as the square root of the water velocity, while the pressure and hence the power required to force the water through the tubes increases as the square of the velocity. That is, the power consumed by circulating pumps increases as the fourth power of the heat transmission when it is attempted to augment the latter by increasing the velocity of the water. As for the thickness of the condenser tube, it is found that this plays so little part in the final result that it can practically be neglected, while the material of the tube is usually determined by other considerations. Attention to the remaining items, namely, avoidance of air-drowning and avoidance of flooding has been rewarded with the most striking results.



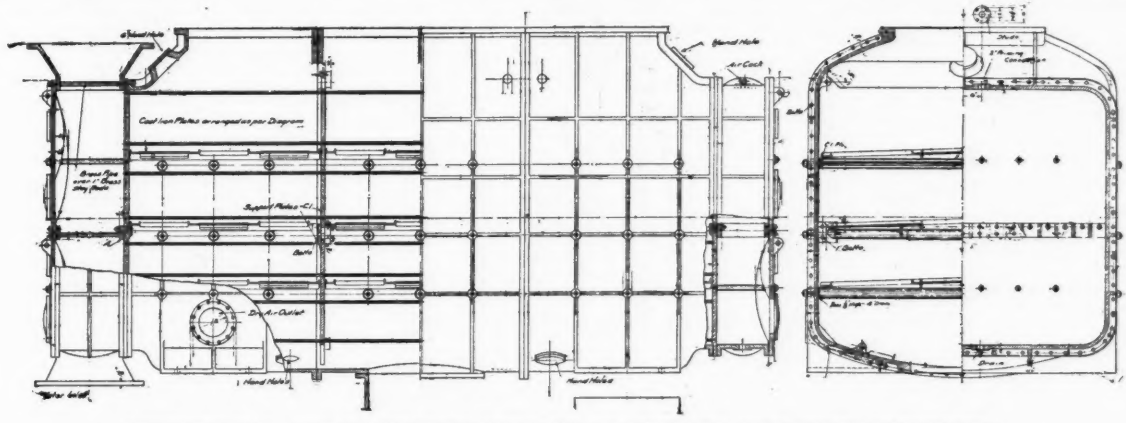
DIAGRAMS OF ONE OF THE FOUR WHEELER CONDENSING OUTFITS AT THE KENT AVENUE STATION, TRANSIT DEVELOPMENT COMPANY, BROOKLYN.

Air-drowning is prevented by avoidance of air leaks, provision of sufficient air-pump capacity and arrangements for removing the air at the lowest possible temperature, and hence at the greatest density. The flooding of tubes has been met in various ways. That it becomes really serious in a large condenser will be appreciated from the fact that the large turbine condenser described later in this article discharges hourly over 220,000 pounds of condensed steam, equal to the discharge of a one-and-three-eighths-inch fire hose. This deluge of water pouring down from the upper tubes upon the lower would so effectively blanket the latter that there could be little direct communication of heat from the steam to the lower tubes.

To avoid this flooding effect, some designers have arranged to have the steam flow horizontally through the condenser. This results, however, in a condenser occupying a great deal of floor space, and does not provide, moreover, for the flow of the air in the natural direction. Other inventors have sought to cut up such horizontally arranged banks of tubes into sections, place the sections one above the other, and then cause the steam to traverse the groups of tubes horizontally in succession, flowing first one way through the upper group, then in the opposite direction, through the next lower group, and so on. This involves, however, a cumbersome, heavy and ungainly condenser shell containing a great deal of waste space.

Equal or greater success has been attained with the much simpler arrangement illustrated in the accompanying drawings, showing one of four Wheeler "Dry Tube" condensers installed in the Williamsburg power station of the Transit Development Company, of Brooklyn, N. Y. In appearance this condenser is similar to the well-known Admiralty condenser, introduced by the Wheeler Condenser and Engineering Company about twenty years ago. It has the merits inherent in that design of being compact and easily accessible.

As will be noted, there are two exhaust steam inlets at the top of the shell to receive the steam from the double-flow Westinghouse turbines installed on the floor directly above. The circulating water from the Wheeler engine-driven centrifugal circulating pump is introduced into the lower compartment of the water box at one end and makes two passes through the tube before being discharged from the upper compartment of the water box. The condensation is collected in a cylindrical well, forming a part of the bottom of the condenser shell, whence it is removed by a Wheeler centrifugal hot-well pump. The air is taken from the side of the condenser at a point near the cold-water inlet and is exhausted by a Wheeler rotative dry-vacuum pump.



LONGITUDINAL AND TRANSVERSE SECTIONS OF WHEELER "DRY-TUBE" CONDENSER.

The novel feature of the condenser consists in horizontal baffles interposed between the several banks of tubes. These rain plates catch the water from the tubes above them and carry it to the outside against the shell, down which it flows to the hot well without coming in contact with other tubes. To permit the passage of the steam past these rain plates there are openings, around the edge of which the plate is turned up to form a vertical lip, preventing an overflow of water. These openings are so staggered that the steam will reach all parts of the tubes, insuring complete utilization of all the surface.

Simple as this expedient appears, the results obtained by means of it have been remarkable, as will be apparent from a consideration of the rate of heat transfer developed in this condenser under working conditions. It was formerly customary to assume the rate of heat transfer through surface condenser tubes, closed feed-water heaters and similar appliances as between 200 and 300 British thermal units per square foot per hour per degree difference of temperature between the water inside the tubes and the steam outside. Inasmuch as the temperature of the water within the tubes rises as heat is absorbed, while the temperature of the steam outside falls somewhat as the mixture becomes richer in air, it is necessary to adopt some method of calculating the average difference of temperature. A simple method is to take the arithmetic mean, that is, add the entering and leaving temperatures of the circulating water and divide by two to find the average water temperature, which is subtracted from the steam temperature, corresponding to the vacuum or from the mean between the latter and the hot-well temperature to give the mean difference in temperature.

There results then as a formula connecting the cooling surface in square feet, or S, the weight of condensed steam per hour, or W, the coefficient of heat transmission in heat units per degree difference in temperature per square foot of cooling surface, or U, and the mean difference in temperature, or D — the following equation: $S = W\,H/U\,D$; where H equals the total heat in the steam entering the condenser above the total heat in the condensation leaving the hot well, as determined from the respective temperatures and reference to the steam table.

The values of U obtained with the condenser herein described have been calculated from a test made on unit No. 6 in the above-mentioned plant on November 27, 1908. This condenser was designed to handle 180,000 pounds of steam per hour and to give a vacuum equivalent to

two inches absolute pressure, with 70° Fahrenheit circulating water.

Results of test of Wheeler surface condenser at the Williamsburg power station in connection with Westinghouse-Parsons turbine unit No. 2:

Time of Reading.	Barometer Reading.	Vacuum, Inches of Mercury.
10:9	29.98	
10:35		28.5
10:55	29.99	
11:10		29
11:30		28.95
11:40		29
11:50		28.95
12:00	29.99	29
12:20		29
12:30		29
12:40		28.95
1:10	29.95	29
1:30		29
2:00	29.96	29
2:25		29
2:45		29
3:00	29.97	28.95
3:15		29
3:30		29
3:45		29

The transmission of heat per square foot per hour per degree difference of temperature was found in these tests, during which the rate of condensation varied from 164,586 pounds to 220,200 pounds of steam per hour, to be between 800 and 900 British thermal units, which is two to three times greater than is obtained from the ordinary surface condenser.

These results show that the guaranteed vacuum could have been maintained with even less condensing surface than was actually installed, although the latter is considerably below usual practice. That is, while the ordinary condenser would contain two or three square feet of surface per rated horsepower, this condenser contains only 1.5 square feet per rated electrical horsepower.

Another point to be noted in connection with the performance shown in the abovementioned test at the Williamsburg station is the high temperature of the condensate at all times, closely approaching the theoretical temperature of the steam vapor. Inasmuch as this condensate is used as boiler feed and as each 10° Fahrenheit amounts to about fifteen per cent of the fuel bill, this is also highly important from the standpoint of plant economy.

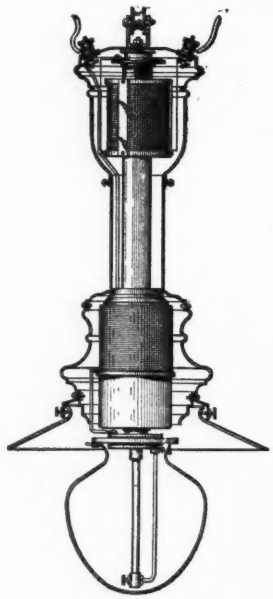
Electric Power in a Gas Plant.

The Providence Gas Company is making an innovation in the machinery used for handling gas by installing an electrical system for the purpose. Bartlett, Hayward & Company, of Baltimore, who have charge of the work, have arranged with the Allis-Chalmers Company, of Milwaukee, for the necessary generating equipment. This will consist of two complete units, each unit being made up of an engine and generator, direct-connected, together with the necessary condensers and electrical control apparatus. The engines are Allis-Chalmers Corliss, cross-compound, direct-connected to 300-kilowatt, 240-volt, direct-current generators.

The Sunray Arc Lamp.

The carbon arc lamp reached a considerable degree of perfection some years ago and came into extensive use by reason of its many advantages, but whether because the most competent designers sought entirely new lines, or the inertia of large commercial interests retarded its progress in this country, it remained practically at a standstill for more than a decade.

An intimate experience with the arc lamp almost since its first commercial introduction and an appreciation of the fact that it has an added advantage of cheapness has led the Sunray Electric Lamp Manufacturing Company, New York, N. Y., to the determination to bring this neglected form of electric light up to a full realization of its possibilities. This company is placing on the market, therefore, an arc lamp called the "Sunray" which it claims will stand the severest tests of both theory and practice.



SECTION OF SUNRAY ARC LAMP.

INDOOR TYPE SUNRAY ARC LAMP.

The Sunray lamp is much smaller than the old type of arc lamp. As may be seen in the accompanying diagram the arrangement of the mechanism of this lamp is perfectly symmetrical, being built on the concentric principle. A one-inch brass tube forms the axis and serves as the support of the other parts. The magnet is wound around this tube at the top and the resistance wire is on a porcelain spool at the bottom. Within this tube there is a square brass tube, which holds the upper carbon and has the pole piece of the magnet attached to the upper end. The dashpot is in the upper end of the outer tube. This tube thus serves not only as a support but furnishes a perfectly dust-proof enclosure for all of the moving parts.

The magnet is wound with fireproof insulated wire and has a practically complete magnetic circuit of soft iron. The resistance coil consists of a special wire having a very high specific resistance and low temperature coefficient. The dash pot has an automatic release on the down stroke, permitting of instantaneous pick-up and feed. This feature, combined with an accurately proportioned sensitive magnet and the Sunray clutch produces perfect regulation and an invisible feed with resulting steadiness in light.

All of the parts are of ample strength and weight for their purpose and can be reached for attention as easily as the parts of an ordinary kerosene lamp burner. Sunray lamps are made to run in multiple on direct-current circuits of 110 to 120 volts and 220 to 240 volts. The 110-volt lamps are built in two sizes consuming 330 and 440 watts respectively, with 240 to 320 watts at the arc. The 220-volt lamps are made in three sizes consuming 440, 550 and 660 watts respectively, with 300, 375 and 450 watts at arc.

These lamps are regularly equipped with a single enclosing globe of opalescent glass, or with an opalescent outer globe and a clear inner globe. An illustration of a Sunray lamp as equipped for indoor service is shown herewith.

Electric Railway Tower Wagon.

A new and very convenient method of application of trackless electric vehicles for electric-railway service is developed in the form of an electric tower wagon manufactured by the General Vehicle Company, of Long Island City, N. Y., views of which are shown herewith. The entire equipment of this tower wagon is mounted on the well-known two-ton chassis of that company. All spring supports and special parts are vanadium steel castings, and all renewable parts are accurately machined to size. Friction has been eliminated by the use of Hess-Bright ball bearings on the armature shaft, and Timkin roller bearings for all wheels and countershafts.

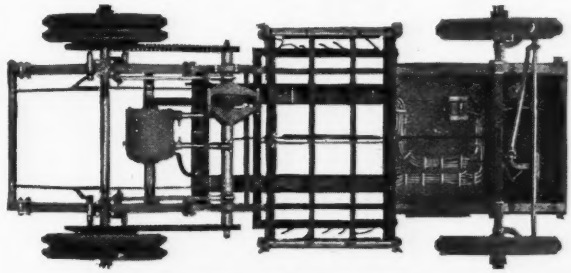
The illustrations show the entire construction of the chassis. The frame is constructed of steel channels of such proportions as will best support the mechanism and carry the load most efficiently. The forty-four-cell storage battery, which furnishes electricity to the motor at eighty-five volts, is suspended below the main frame in a substantial cradle, where it can be reached easily. The battery is in sectional form, in crates of such weight and size as can be easily removed and replaced from either side of the vehicle, entire or in sections.

The controller is the continuous-torque type, which changes motor speeds by degrees without interrupting the power supply. This gives a smooth, even acceleration, without jar or strain of any kind. This increases the life of the controller, battery, motor, chains, sprockets, gears and tires.

The single electric motor used is especially designed for the sort of service demanded in electric transportation. It is built along the lines of an electric-railway motor with strong, rigid shaft, simple, durable brush fittings, and a capacity for heavy overloads. The armature shaft of the motor turns on frictionless ball bearings which increase the value of the other advantages of this design. The motor is suspended on a cross-bar pivoted to the side frames in front of the rear axle. This pivoted suspension keeps the motor shaft parallel with the countershaft throughout the entire range of chain adjustment, and permits the successful use of an efficient silent chain drive. The motor is totally enclosed and protected from water and dirt at all times. It is high above the ground and may be easily examined from the rear by opening a hinged cover in the motor frame.

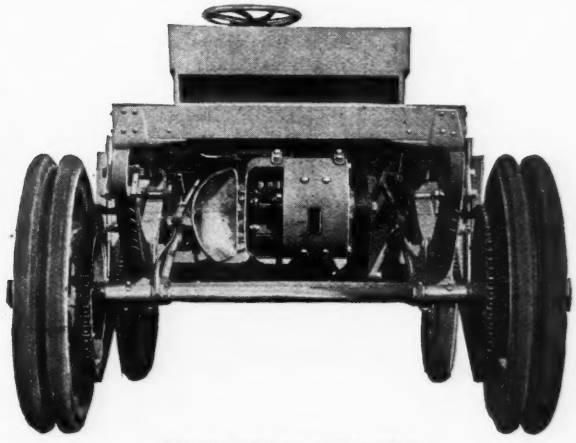
Easy-running roller-bearing chains drive the rear wheels from the countershaft. Large diameters and properly designed teeth, combined with the frictionless roller chain, decrease transmission losses to a minimum. A single broad silent chain of the tooth-link type drives the countershaft from the motor pinion. A simple and rigid adjustment is provided to keep the chain in its most efficient operating condition.

The artillery-type wheels have roller-bearing hubs, giving maximum strength and minimum friction. Solid rubber tires are used on all wheels. To carry the load easily and transmit tractive effort efficiently, the tires vary in design for different capacities. On the trucks of 4,000 pounds capacity and upward broad single tires are used in front, and solid double or twin tires on the rear wheels. The half-elliptic springs, both front and rear, are designed for the load liable to be imposed upon them according to standard capacity rating. Internal expansion leather-faced brakes on both rear wheels are controlled by a foot lever at the base of the steering post. The steering gear is wheel-operated through a vertical steering column, to the gear and sector, which can be relied upon at all times, and is simple, strong, and easily handled.



UNDERVIEW OF CHASSIS.

GENERAL VEHICLE COMPANY'S TOWER WAGON.



REAR VIEW OF CHASSIS.

The tower wagon has a speed of twelve miles per hour, and a range of service of forty miles on one charge of battery. The wagon has sufficient space for seven men in addition to the driver; also space for tools, and materials for repairs.

One of the important advantages of the electric wagon is its immediate readiness for service; where adopted it will not be necessary for electric-railway companies to maintain a team of horses constantly harnessed, ready for emergency service; the constant care of horses can be eliminated.

A broader adoption of electric vehicles by street-railway companies will enable them to entirely discontinue horse service. The amount of current required to charge

the battery for wagon operation will not be any source of expense to the electric-railway company. The electric emergency wagon can be held always ready for immediate service, and drives at a speed to the limit of safety of city traffic.

The Heany Multiple Alternating Current and Direct Current Arc Lamp.

An extremely simple and efficient arc lamp with a number of new features and based on the Heany patents is being placed on the market by the Lord Electric

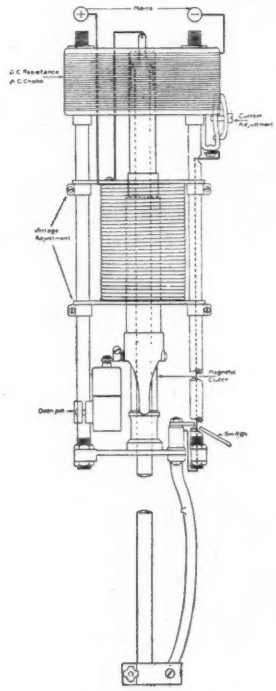


DIAGRAM OF HEANY LAMP.

Company, 213 West Fortieth Street, New York, N. Y.

The most notable feature of this lamp is the combined core and clutch which regulates the length of arc. This core consists of two semi-tubular members pivoted together and arranged to slide on the carbon-containing tube which runs through the center of the solenoid. At the lower end of the clutch are two jaws adapted to grip the upper carbon. When the armature is energized by the coil surrounding it the semi-tubular members will act as like poles and repulsion will take place, throwing the jaws together and gripping the carbon. Responding at the same time to the effect of the solenoid coil, the carbon is drawn upward establishing an arc. As the current decreases slightly the jaws relax, allowing the carbon to slip downward. This obviates any breaking of the arc. The current consumption of this form of lamp is from three-and-one-half to five amperes at from ninety to ninety-five volts arc voltage on a 110-volt line.

Tests made with careful adjustment show a life of the carbons at one trimming of something over 200 hours. It is rather interesting to note that the following severe test of the lamp was made in order to demonstrate the electrical and mechanical stability of the lamp to the satisfaction of its makers: The lamp was taken burning from the line, plunged into water for twelve hours, and on being taken out was immediately put into the circuit again, burning as well as ever. The Lord Electric Company is also developing other types of arc lamps adapted for va-

HEANY ARC LAMP.

rious lighting requirements, but embodying the same general principles.

Telephone Train Dispatching on the Atchison, Topeka & Santa Fe Railway System.

A system of telephone train dispatching has recently been completed and put into service by the Atchison, Topeka & Santa Fe Railroad Company on its Illinois division, between Chillicothe, Ill., and Dearborn Station, Chicago, a distance of 134 miles. On this circuit the dispatcher is located at Chillicothe. There are thirty way stations in which telephones and selective equipment have been installed.

With the completion of this circuit, the Atchison, Topeka & Santa Fe trains running out of Chicago are handled by the telephone as far as Newton, Kan. A total of 660 miles is covered from Chicago to Newton. There are on this section a total of 170 way stations, all equipped with standard Western Electric telephone train-dispatching apparatus and Gill bridging selectors. Each of these stations has direct communication over the telephone with the dispatcher of its division.

A New Electric Rectifier.

We have had an opportunity, says the *Lancet* (of London, Eng.), of examining a new instrument for rectifying alternating currents into unidirectional impulses. It is supplied by the Premier Ampero Electric Company, London, W., and will be found a most useful and efficient apparatus for charging accumulators, such as are used for motor ignition and various kinds of medical work, in those districts where the current from the main is an alternating one. The principle upon which it is constructed is somewhat the same as that devised by Doctor Batten some years ago, but it is more efficient and rather more silent in action. A great feature of this instrument is that the point on the pressure curve of the alternating supply, where the current is picked up and cut off, is adjustable and can be arranged to take place at the voltage of the cells. At such times as the charging current is at a lower voltage than that of the cells undergoing charge the circuit is open and no current can pass back through the rectifier. When properly adjusted, which is a very simple procedure, there is no visible sparking at the contacts. On our visit we saw the instrument converting an eighty-five-cycle alternating current into direct current and charging some ignition cells, and also running a small direct-current, shunt-wound electric motor, which latter, as is well known, will not work with an alternating current. If the main supply should fail from any cause the instrument cuts itself out of circuit automatically. It will work on any periodicity in ordinary use, starts and runs on any load, requires no attention, and is efficient in any position. The makers claim that the instrument will go for six hours a day for six months without attention, and then all that is needed is a new set of platinum contacts, at a trifling cost. The directions to be followed are extremely simple, and altogether we have seen no better instrument for its purpose.

It is predicted that logging by electricity will soon become the general practice in the woods of British Columbia, at all points where electricity is available. With the displacing of the steam engine, ninety-five per cent of the forest fires would disappear.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, NOVEMBER 12.—Louis Brennan, with his wonderful monorail, gyroscopically-balanced locomotive, is once more in the public eye. A few years ago Mr. Brennan demonstrated the possibilities of his remarkable invention in the form of a model which, owing to its small weight, could be made to run on a single wire, while its evolutions on a single rail were well-nigh perfect. Since then, the inventor has been working quietly upon a full-size locomotive, but this was far from complete when news reached him early this week that a German engineer intended to give public trials in Berlin with a similar contrivance having a length of seventeen feet. Without any hesitation, Mr. Brennan decided, incomplete as his engine was, to give public trials of his full-size structure. This is forty feet long and carries two gyroscopes three feet six inches in diameter, each weighing three-quarters of a ton. The gyroscopes work at 3,000 revolutions per minute. They are on a vertical plane, and the working of the unfinished car, with only a twenty-horsepower generator for supplying energy to the electric motors which drive the wheels, showed the degree of perfection obtainable. No feeling of instability was detected. Ordinarily an eighty-horsepower generator will be employed, but the apparatus which first came handy upon an emergency had to be used, or the demonstration could not have been given. The gyroscopes are driven by shunt motors. Mr. Brennan claims that the Germans have copied his ideas, hence his desire to get his full-size vehicle before the public. The vehicle is ten feet wide and will be thirteen feet to the roof, when this is fitted. At present only the driver's cab is enclosed. The car is mounted on four wheels, in pairs, on independent trolleys, and these readily negotiated a curve with a radius of thirty-five feet. It may be stated that Mr. Brennan has been financially assisted in his experiments by the British and Indian governments to the extent of $75,000.

The London County Council has at last evolved a system of electric traction which will overcome the objections of the Astronomer Royal to the construction of tramways in the neighborhood of the Royal Greenwich Observatory. The Astronomer Royal stated that neither the conduit system nor the ordinary trolley system, nor even the three-wire system, in which the currents in the return circuit are balanced, eliminated the danger of stray electric currents which would interfere with the working of the delicate instruments in the observatory. Consequently, it has been arranged to construct the tramways to which objection had been taken upon the overhead system, but using two wires instead of one for each track. In this way only can the complete insulation of all the conductors be assured.

In consequence of two recent accidents in which passengers upon the top decks of tram cars have received fatal shocks from the trolley standard, the Board of Trade has issued a warning to tramway authorities. On all cars there is fitted a red lamp, which should glow when the framework of a car is "alive," but periodical inspection of this circuit is not general and on each occasion the circuit has been interrupted. The Board of Trade now suggests a daily inspection to ascertain that the trolley standards are properly insulated, and also the provision of a magnetic blow-out fuse which will give an audible signal of the failure of the insulation.

The action by the General Electric Company against the English Welsbach Company for using the trade-mark "Aur" upon metal-filament lamps which the latter company is selling, promises to be a long and complicated affair.

An amusing case has just concluded in the law courts in which a music-hall performer who styled himself a "hypnotist, bloodless surgeon and medical electrician" has been ordered to repay to a pupil of his $5.000 paid as premium to be taught these learned professions. Frankly speaking, the whole thing was a sham, hypnotic "subjects" forming part of the "doctor's" traveling company. A part of the show was the "marvelous" feat of taking a shock at 30,000 volts, but the apparatus turned out to be no more dangerous than an ordinary hospital high-frequency equipment, to which added effect was given by firework paper. The exposure in court has had the effect of the "doctor" being driven off the stage of a music hall where he continued to perform after the verdict against him was pronounced.

At the meeting of the Institution of Electrical Engineers last night, a marble bust of the late Dr. John Hopkinson was presented by his widow. Dr. John Hopkinson was twice president of the institution and met his death in 1898, at the early age of forty-nine years, during a holiday in the Alps. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, NOVEMBER 11.—The French government has been engaged for some time past in organizing a system of military wireless telegraphy in order to make connection in the best possible way between the Eiffel Tower and the larger posts in various parts of the country and also to give the proper connection between the coast stations, so that the entire country is covered in this way. At the same time measures have been taken for the proper signaling in the Mediterranean region, so as to connect with the ports which are established at Algiers and Tunis. On the fifth of November the high power station at Toulon was opened for use, and it is exclusively devoted to military service like the stations on the north African coast at Oran and Bizerta. These stations use a standard wave length of 750 metres and work daily from 9 a. m. to midnight. It is intended from now on to use wireless signals between the coast stations and Paris to replace ordinary telegraphy as much as possible. For the battleships these are to be provided with an extensive outfit such as was recently installed on the Patrie. There is being erected a high power station on the coast of Rufisque, in Senegal, and this is to connect with the Eiffel Tower.

Peat is to be employed in a large electric plant recently erected in Germany at Aurich, in Hanover, and the Prussian government is interested in the enterprise. The station has already started to work and is furnishing current. It is located near extensive peat bogs, and is to use this kind of fuel exclusively. A large amount of current from this plant is to be used by the government for light and motors in the port of Emden.

It is intended to erect an electric plant of some size upon the Rhine in the region of Kembs, Alsace. This work is to be carried out in connection with the proposed improvements in the navigation in this locality, and a commission appointed by the different states interested in the matter is now considering the project. The final plans for the work are nearing completion at present.

In Austria there is to be installed a network of power lines covering the country in the region of Gloggnitz. The station is located on the falls of the Weissenbach. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., NOVEMBER 20.—At a meeting of the bondholders of the Mexican Northern Power Company, held in Montreal, permission was given for an increase of the bond issue from $7,500,000 to $10,000,000. The capital stock is also to be increased from $10,000,000 to $15,000,000.

The electric log piler recently installed by the Maclaren Lumber Company at Buckingham, Que., has proved a success. The logs are hoisted to the rollways by means of an endless chain which is run by an electric motor installed on a float placed in the eddy.

A special committee, dealing with the standardization of equipment, reported at a meeting, held in Toronto, Ont., of engineers representing twelve municipalities in the Niagara Power Union, in favor of the adoption of a luminous arc lamp in business districts and a similar type of tungsten incandescent lamp for use in the residential districts.

The city of Hamilton, Ont., will shortly launch an organized movement to get the Dominion government to build a new Welland Canal on the old Grand River-Hamilton Canal survey. It is claimed that the scheme would give Hamilton the cheapest power on the continent, and this, it is believed, will induce 350 manufacturers in Hamilton to throw their influence in its favor.

The Galetta Electric Power and Milling Company, which took over the plant of the Arnprior Electric Light and Power Company two months ago, is now supplying the town of Arnprior with electricity. The Galetta plant is one of the most up-to-date of electrical concerns. The waterpower is quoted at from 1,800 to 2,400 horsepower, with a twenty-eight-foot head.

The Board of Railway Commissioners for Canada, in reference to the application of the Bell Telephone Company against the Nipissing Power Company, has ruled that all electric power or transmission companies, whether federally or provincially incorporated, must obtain an order of the board before crossing the lines of any telephone company. The intent of the law was to protect the public.

That the Canadian telegraph and telephone companies will stand entirely aloof from the great merger that is on the point of consummation in the United States, is emphatically declared

by the officials of the various companies in Canada. According to the New York despatches, the Bell Telephone Company of Canada is to become a part of the combine. This is absolutely denied, as the control of this company is firmly in Canadian hands. So, too, with the telegraph companies. Neither the Canadian Pacific Railway Telegraph nor the Great Northwestern is to form a part in the merger, although both have business connections with individual companies across the border. Besides the Canadian Pacific, the Great Northwestern and Western Union in Canada, the Mackenzie and Mann transcontinental railway system is building its own telegraph line, as is likewise the Grand Trunk Pacific Railway. To the Dominion government is left the non-productive lines on the St. Lawrence and Labrador, and that to the Yukon and other scattered bits in lone territories.

A definite announcement concerning the gigantic scheme of the Dominion Power and Transmission Company, which will build an electric passenger and freight line from Niagara Falls to Hamilton, Toronto and Windsor, in the province of Ontario, with a branch from Hamilton to Waterloo, Guelph and that district, may be expected early next year. The company is said to have matters in good shape for carrying the great undertaking into effect, and is understood to be only waiting the federal parliament's verdict on applications for certain other charters before making a move. The promoters are applying for power to secure running rights over the Radial Line from Burlington to Toronto. The Dominion company at present has an electric line running from Beamsville to Brantford. A new line for high-speed electric cars is to be built from Niagara Falls to Hamilton, and the present Radial Line extended from Oakville to Toronto. The London & Lake Erie Company, capitalized at $2,000,000, to run from London to Brantford. will be a second link in the big scheme, while the purchase of the Windsor, Essex & Lake Shore line, for which negotiations were begun some time ago, will probably complete it.

Among the important questions of international interest dealt with in the report of the International Waterways Commission, tabled in the Canadian Commons, are those concerning the Niagara and other hydroelectric enterprises. In regard to the diversion of 40,000 cubic feet of water per second from the lower Niagara, it was agreed that such would not seriously affect the scenic beauty of the rapids. The commission had heard nothing of the Long Sault damming project since November last. The new plan is now before the Dominion government. In respect to the Cedar Rapids proposition, the commission recommended the granting of the application of the Cedar Rapids Manufacturing and Power Company to construct power works on the north side of Cedar Rapids, and to divert 56,000 cubic feet of water per second from the St. Lawrence. American power plants divert from the Niagara Horseshoe Fall a larger amount of power than was supposed. W.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

POWER PLANT FOR SNAKE RIVER—Work is being pushed on the new $2,500,000 power plant of the Idaho-Oregon Light and Power Company in the Ox Bow of the Snake River. The plan is to construct a dam one hundred feet in height and to dig a tunnel through 1,000 feet of solid rock. The water is to be diverted from a long bend through the tunnel. At present it is intended to install a 100,000 horsepower plant, but arrangements are made so that the horsepower can be quadrupled. The large part of the power developed is contracted for by mining companies in the Seven Devils district.

NEW MEXICO POWER PROJECT—One of the most important hydroelectric projects in New Mexico is under construction at High Rolls. The water of the perpetual stream which flows through the town is to be utilized for generating power. The construction of the pipe line which is to carry the water from High Rolls to the brink of Box Cañon was started recently. At Box Cañon the water will have a fall of 1,000 feet, with sufficient flow to generate 5,000 horsepower of electrical energy. The proposed hydroelectric plant will be admirably situated and more units can be added as the demand for power may justify. The Alamo Water Power Company, of High Rolls, is carrying out this enterprise. It will build transmission lines from the hydroelectric plant to the towns of Alamogordo, Tularosa and other places in this part of New Mexico. Later on the power transmission system may be extended to El Paso, Tex. H. La Salle is general manager and chief engineer of the company.

LIGHTING AND POWER.

(Special Correspondence.)

FESTUS, MO.—This city has voted bonds to the amount of $15,000 for electric lights. P.

ANGLETON, TEXAS—E. M. Masterson will begin at once the erection of an electric-light and ice plant. P.

FOREST GROVE, ORE.—A franchise has been granted to A. Welch to furnish an all-night electric street-lighting service for this city. A.

MERRILL, WIS.—It is stated that a large company is planning the construction of another dam across the Menominee River near here. The proposed dam will develop 6,000 horsepower. M.

RAMSAY, LA.—The Greenlaw Lumber Company of this city is installing a modern electric light plant.

NASHVILLE, ARK.—B. H. Rainwater, Junction City, Ark., is figuring on the installation of an electric-light plant. P.

TERRELL, TEX.—This city will vote, November 23, on the issuance of $10,000 in electric-light improvement bonds. P.

PAENIA, COLO.—The German Mesa Electric Illuminating Company has been incorporated with a capital stock of $2,500. P.

ACKERMAN, MISS.—Contract for installing a $35,000 light and water plant has been let to Walton & Wagner of Atlanta.

LINDSAY, OKLA.—A water system and an electric light system have recently been installed in Lindsay at a cost of $40,000.

SACRAMENTO, CAL.—The Great Western Power Company is preparing to supply power for the gold dredgers at Folsom, Cal. A.

MINNEAPOLIS, MINN.—It is proposed to install electric side lights on Central Avenue, and the St. Anthony Falls Bank has subscribed $1,000 towards it. C.

SANTA ROSA, CAL.—H. C. Eastman has been granted a franchise for an electric transmission line from Sebastopol to towns in western Sonoma County. A.

MARTINEZ, CAL.—Bids will be received up to December 6 for a fifty-year franchise for an electric distributing system along the roads of Contra Costa County. A.

SAN MATEO, CAL.—Bids will be received by the Board of Supervisors for the installation of electric lights in the East San Bruno and Colma lighting districts. A.

LAKE CITY, MINN.—The Lake City Lighting, Heating and Plumbing Company has the contract for the installation of electric motors in the elevators of Peter Beck & Son. C.

CHIHUAHUA, MEX.—The state government has granted to Manuel Gameros and Alberto Terrazas, both of this city, the right to develop hydroelectric power in this district. A.

SPOKANE, WASH.—The Northern Idaho and Montana Power Company has acquired the plant of the Big Fork Water Company, at Kalispell, Mont., and will enlarge and improve it. A.

OKLAHOMA CITY, OKLA.—At a recent election two twenty-one-year franchises were granted to the Oklahoma Gas and Electric Company for gas and electric-light privileges.

LAKE MILLS, WIS.—A special election is to be held at Lake Mills to decide whether to purchase the plant of the Creamery Package Company, to be used as a lighting and power plant. M.

SHERIDAN, ILL.—The Fox River Hydro-Electric Company has been incorporated with a capital of $54,000, to operate electric plants. The incorporators are: J. W. Carr, R. J. Rowe and T. H. Bellrose.

BEND, ORE.—Loiis Deener, of Prineville, vice-president and manager of the Pioneer Telephone and Telegraph Company, has applied for a franchise for an electric-light and power plant in this city. A.

CHESTER, S. C.—The new Eureka mill, as well as the old section of the plant, is being fitted out with electric drive, and the entire machinery of the plant will be driven by electricity as soon as the change is completed. L.

APEX, N. C.—The town has granted a twenty-year franchise to A. J. Martin, to build and operate an electric plant, which is to be installed by January 1, 1910. It is probable that power for industrial plants will also be offered. L.

PORTAGE, WIS.—The Southern Wisconsin Power Company are erecting an electrical transmission house that will cost $40,000. The building which will be completed, will be used as a distributing point of the electrical power from the Kilbourn dam.

GOUVERNEUR, N. Y.—The Oswegatchie Light and Power Company is preparing to build a hydro-electric plant at Hailesboro. The Oswegatchie River, which has a natural fall of twenty-five feet will be dammed, so that 3,000-horsepower will be obtainable.

DANBURY, N. C.—The state has granted a charter to the North Carolina Traction Company, $2,000,000 capital, to build a system of electric railways diverging out from Danbury, developing surrounding timber lands, etc. H. P. McKnight, of Southern Pines, is the principal stockholder, associated with him being E. Hillman, Aberdeen, N. C.; W. C. Reflert, Harrisburg, Pa., and E. L. Krafft, of Indianapolis. L.

SALT LAKE CITY, UTAH—The Manti Light and Power Company has filed application with the state engineer for ten cubic feet per second of the flow of Manti City Creek in Sanpete County for electrical power purposes. The company intends to erect a loose rock dam and divert the required water by means of a pipe line, half a mile long, to the power house. The plant

will be equipped with two Pelton water wheels operating under a head of 444 feet of water and generating 430 horsepower. The power generated will be used for electric lighting and propelling machinery in Manti and towns in the vicinity.

STEVENS POINT, WIS.—The Dells Paper and Pulp Company of Eau Claire has given W. U. Uke & Company the contract to erect a dam about 900 feet long across the Chippewa River at Jim Falls. The structure will be on concrete and stone. A 50-foot head will be obtained. M.

OROVILLE, CAL.—The Western Power Company has completed its installation and current is now being supplied to the substation at Oakland. This company has one of the longest transmission lines in the United States, extending from Big Bend to Oakland, a distance of 158 miles.

DARLINGTON, S. C.—The Darlington Water and Electric Company has been granted a charter, with $50,000 capitalization, to conduct a general power and light business. The incorporators include A. P. Maloney, president; W. N. Haynesworth, vice-president, and L. C. Ritchie, secretary. L.

CANTON, N. C.—It is reported that another electric line in this section of the state will be built to extend from Asheville to Waynesville, via Canton, through the mountain section, a distance of about thirty-five miles. Mr. McCormick, of Chicago, is interested and is seeking to procure right of way.

YORK, PA.—To overcome the handicap of scant current during times of low water at the York Haven Water and Power Plant, the Edison Company, of this city, is installing a 525-kilowatt engine and generator at its local plant. This with other machinery put in will, it is thought, meet every emergency. O.

ROXBORO, N. C.—The town has let the contract for electric lights for Roxboro, Mr. J. Maxwell, of the General Electric Company, at Baltimore, having been in the town for some days in the interests of his company and in advising with the Council relative to the installation of the system. L.

CLINTON, N. Y.—Mr. C. A. Borst has made arrangements with the council whereby he has secured a contract to furnish municipal street lighting. He has just placed an order for station equipment with Allis-Chalmers Company, consisting of an engine and a 100-kilowatt, 2,300-volt, sixty-cycle, two-phase generator.

ROCK HILL, S. C.—The Rock Hill Water and Electric Company is chartered, with a capital stock of $100,000, to carry on a general power, light and water business. Those interested include A. P. Maloney, president; W. T. Fewell, vice-president; J. S. Mitchell, secretary, and L. C. Ritchie, treasurer. L.

ST. LOUIS, MO.—The Light and Development Company, of St. Louis, has made application to the Municipal Assembly for a franchise to run for thirty years and proposes, if the franchise is granted, to go into competition with the Union Electric Light and Power Company in supplying electric light in St. Louis.

JACKSON, GA.—The Schott Engineering Company, of Chicago, is building the power transmission lines to Macon, Ga., and other points, steel towers being used costing $500 each, and being set at a distance of 500 feet apart. The first line is being constructed from the power plant on the Ocmulgee River to Macon. L.

MARION, S. C.—The Marion Water and Light Company has been granted incorporation papers by the state, with a capital of $50,000, to conduct a water and light business, officers and stockholders being as follows: President, A. P. Maloney; vice-president, P. A. Willcox; secretary, J. S. Mitchell, and treasurer, L. C. Ritchie. L.

HUNTSVILLE, ALA.—Articles of incorporation of the Gurley Light and Power Works Company have been filed in the Probate Court. The company has an authorized capital of $10,000, and $6,000 of this amount has been subscribed. The corporation has a franchise at Gurley, and a contract to light the streets with electric lights.

ALBANY, N. Y.—The Islip Electric Light Company, of Islip, has been incorporated with a capital of $20,000. The directors are: William H. Moffatt, Frank D. Creamer, John H. Vail, Bradish Johnson, Stephen Kelly, Charles O. Doxsee, Caleb T. Smith, Benjamin Welles, Elliott J. Smith, George W. Weekes, Jr., Benjamin S. Raynor and Egbert Z. Smith of Islip, and J. Theodore Wulf of East Islip.

EAU CLAIRE, WIS.—The Wind Electric Power Company has been organized with a capital stock of $30,000 for the purpose of manufacturing a machine using wind power for the generation of electricity, which can be used to run farm machinery, and for other useful purposes. The incorporators of the company are Frank S. Culver, of Madison, and R. T. Lange and F. S. Lange, both of Eau Claire. M.

CHATTANOOGA, TENN.—A deal has been consummated by which the City Gas and Electric Company, of Murfreesboro, passes into the hands of Davis & Elam, proprietors of the Walter Hill Power Company. The two companies have been operating in Murfreesboro for several months, and the competition was so sharp that the price of electricity was exceedingly low. The new company has announced an increase in rates.

JUNCTION CITY, ORE.—The Northwestern corporation has purchased the electric-light plant here and will soon install a twenty-four-hour service. As soon as the transmission line can be built the city will be supplied with light and power from the plant at Springfield, which already furnishes electricity for that city and for Eugene.

KILBOURN, WIS.—The engine running the dynamo which furnishes Kilbourn with electricity for lighting was so badly wrecked recently that it is beyond repair. It has been decided to use power from the Southern Wisconsin Power Company's hydroelectric plant here. Kilbourn will be without lights until this arrangement is completed. M.

HAMPTON, VA.—Announcement is made that the Capital City Beach Corporation, which holds extensive water-front property above Buekroe Beach, has perfected arrangements with the Newport News & Old Point Electric Railway Company to extend its electric lines to the site mentioned, where a summer resort and numerous cottages will probably be built soon. L.

SALISBURY, N. C.—At midnight, November 15, electric power was turned on for the first time over the lines of the Southern Power Company, via Albemarle, the power coming from the Great Falls plant, in South Carolina. A transformer station, representing an outlay of $100,000 is in use here, this station to be used as a center of distribution for a number of towns within a thirty-mile radius. L.

SYRACUSE, IND.—The Syracuse Electric Power Company has completed its hydraulic plant on the Elkhart River, six miles from this city. The company has built a transmission line from the plant to Syracuse, Milford and Benton, a distance of seventeen miles. In addition to furnishing these towns with light and power, a large number of farmers have tapped the wires and equipped their country homes with current for lights and power for grinders, pumps and churns. The company was organized by J. S. Neff. S.

BRISTOL, VA.—The Bristol Gas and Electric Company has closed a deal for the harnessing of a river near Bristol, for the purpose of generating electricity for light and power purposes. The deal involves between $250,000 and $500,000, and under the contract with the water power company it is to deliver the current to a substation in Bristol on or before July 1. The power will be sufficient to run all of the industries in Bristol and many more. Ben L. Dulaney, of Washington, is the president and principal owner of the company.

ROCK HILL, S. C.—The Town Council has rejected three propositions made by the Philadelphia owners of the present city lighting plant, one to sell for $145,000, and the other two for short and long term contracts, and has voted for municipal ownership, and a petition for a $35,000 bond issue for lighting purposes was ordered circulated. The town will probably order the old company to remove its poles from the streets. From a different source is announced the organization of an electric-light and power company for Rock Hill, by local and other incorporators. L.

CHARLOTTE, N. C.—There is a rumor that the J. B. Duke interests, controlling the Southern Power Company, of this city, are considering the purchase of the entire Whitney plant, near Salisbury, N. C., upon which many hundred thousand dollars had been spent, prior to the suspension of operations, resulting from legal entanglements. The Whitney company rivaled the Southern Power Company in its possibilities, and the rumor of a possible merger of these two interests, with the Dukes as the largest financial backers, has created much interest in electrical circles. L.

NEWPORT, N. Y.—The directors of the Newport Electric Light and Power Company have made arrangements with George W. Fowler & Company, 20 Broad Street, New York, to offer for sale $50,000 first mortgage six per cent gold bonds of the Newport company, proceeds from which are to be used for extensions and improvements to the property. These bonds are part of an authorized issue of $75,000, permission for which issue was granted by the Public Service Commission, Second District, state of New York, in 1908. The Newport company owns valuable water rights on the West Canada Creek in Herkimer County, from which stream power is derived to run the plant. While at the present time less than 500 horsepower is being used, the available capacity of the stream at Newport exceeds 2,500 horsepower, and developments are now under way, whereby the full capacity of the stream may be utilized. A new dam and power house will also be constructed. Originally the electric system was direct current, but an entirely new system of alternating current high-tension service is being planned, and will be installed with transmission lines extending to Cold Brook, Poland and the surrounding country within a radius of fifteen to twenty miles, in which localities, franchises and municipal contracts have been secured. Work on these improvements will be started early in 1910.

ELECTRIC RAILWAYS.

(Special Correspondence.)

MARSHALLTOWN, IOWA—It is proposed to raise $100,000 towards the construction of an interurban to Grundy Center. C.

OAKLAND, CAL.—The Oakland Traction Company has been granted a fifty-year franchise along Grant Avenue in this city. A.

SIOUX CITY, IOWA—It is stated that the Sioux City & Spirit Lake interurban will commence construction next spring. C.

LAWTON, OKLA.—The Lawton & Fort Sill Electric Railway Company has been incorporated, with a capital stock of $200,000.

STEVENS POINT, WIS.—Work has been commenced on the survey of the route of the Chicago & Wisconsin Valley Electric Railway to Portage. C.

MOLINE, ILL.—The Tri-City Railway Company is planning several extensions and improvements that will cost in the neighborhood of $1,000,000. V.

BERKELEY, CAL.—The Southern Pacific has begun work on its double-track electric ferry line from San Pablo Avenue eastward to the Santa Fe. A.

WINONA, MINN.—The La Crosse and Winona Traction Company has asked for a fifty-year franchise for an electric line to La Crosse, via Galesville. P.

HANFORD, CAL.—F. S. Granger, promoter of the Fresno-Hanford interurban electric railway, states that he has sold bonds of the company to the amount of $625,000, and that he expects to sell the balance. A.

MONTREAL, CAN.—The Canadian Car and Foundry Company has recently been organized, with a capital of $11,500,000. This new company, a consolidation of several smaller concerns, has elected N. Curry as president.

INDIANAPOLIS, IND.—The Commissioners of Marion County have granted the Beech Grove Traction Company, Louis McManies, president, a franchise to build a traction road over the Churchman Pike from Beech Grove to Indianapolis. S.

DELPHI, IND.—A $68,000 subsidy has been voted by Deer Creek, Monroe and Burlington townships in Carroll County in aid of the construction of the Delphi, Flora & Burlington traction line. E. W. Bowen, president of the company announced that the survey would be made at once and the contract let as soon as completed. S.

NEW CASTLE, IND.—Track laying on the Indianapolis, New Castle & Toledo line has been completed between this city and Indianapolis. The work on the car barns, overhead construction and the installation of machinery in the power house is being pushed. The purpose to have cars in operation before Christmas will be carried out. S.

NEW YORK, N. Y.—President Miller, of the New York, Westchester & Boston Railway, announces that his road will proceed at once with the building of a line to White Plains, in addition to its line through the Bronx and Sound shore section of Westchester, and that the contracts for building this part of the road have been let.

LOGANSPORT, IND.—A petition has been filed with the County Commissioners by the Indiana Northwestern Traction Company asking for a franchise to build and operate an electric road through Cass County. The company has surveyed a route which parallels the Panhandle tracks by way of Lake Cicott, Monticello and Renselaer. S.

CHARLOTTE, N. C.—The 4 C's Company, E. D. Latta, president, is preparing to build a short-cut line out First Street, which will divert a large part of its street-railway traffic from a grade-crossing to the new route passing under the Southern Railway, by which route it is expected that a line to the Catawba River, twelve miles distant, will shortly be constructed. L.

SEATTLE, WASH.—A subscription list with subscriptions to the amount of $160,000 has been circulated among the property owners in this city, Georgetown and the Dumwamish Valley, for the purpose of completing an electric line to Tacoma. The Tacoma Short Line when completed will parallel and compete with the line of the Puget Sound Electric Company.

SANTA ROSA, CAL.—The Highland Pacific Railway Company has filed articles of incorporation for the purpose of building seventy miles of standard gauge electric railroad from Lakeport, the county seat of Lake County, to Santa Rosa. When this is completed it is believed, that it is the purpose of the company to extend its line to the shores of San Francisco Bay and establish a terminal there.

FREEPORT, ILL.—Several local business men will endeavor to have the Rockford & Interurban Railroad Company take over the Freeport Railway, Light and Power Company's plant and franchise in this city and it is understood that men of wealth in this city will attempt to raise a bonus for the interurban company if it will consent to take over the holdings of the local company.

CHARLESTOWN, W. VA.—A charter was recently granted to the West Virginia Railway Company for the purpose of constructing a railroad from Keyser, on the Baltimore & Ohio, through Grant and Pendleton counties to the Virginia state line, and ultimately to connect with the Chesapeake & Ohio at Clifton Forge. The company has a capital stock of $200,000, and is backed by New York capitalists.

LAFAYETTE, IND.—The Indiana Northern Traction Company, with home office in Marion, Ind., has been granted a franchise by the Commissioners of Tippecanoe County, for the construction of an interurban road from Battle Ground to Reynolds. The company is capitalized at $500,000 and will, it is said, eventually build the road on north to Hammond. George A. H. Shiedler, E. W. Neal, B. F. Burk and George Breed are the directors. S.

NEW YORK, N. Y.—The Dry Dock, East Broadway & Battery Railway Company has recently filed an application to electrify a part of its line, between Centre Street and the Bowery. The company has no intention of running electric cars in Canal Street, and it will probably continue with horse cars, as in the past. There are at present five applications for street-railway companies for the use of the bridge.

TOLEDO, O.—Announcement has been made that grading will be started yet this fall on a new electric railway to operate between Alliance and Ravenna, O. The new line, which will be twenty miles long, will parallel the Cleveland & Pittsburg, giving a direct line from Alliance to Cleveland. A new company has been organized, but it is understood that Henry M. Everett, of the Lake Shore Electric, and C. R. Morley, of the Stark Electric, are interested in the movement. H.

INDIANAPOLIS, IND.—It is reported that a reorganization of the Indianapolis, Crawfordsville & Western Traction Company has practically been decided upon by the stockholders with Hugh Doughterty, of this city, as president, and A. E. Reynolds, of Crawfordsville, secretary. A petition will be filed in the Federal Court asking for a foreclosure and sale of the road, which is now in the hands of a receiver. It is the purpose of the reorganized company to buy the property. S.

BEAUMONT, TEX.—City Attorney Marvin Sourlock has asked permission of Judge David E. Bryant, of the United States Court, for permission to file suit against the Beaumont Traction Company. He asks to be allowed to sue on behalf of the city for damages done the paving by the traction company, and also to file a suit to forfeit the franchises of the company. If the latter request be refused, he asks in the alternative to be permitted to file an intervention in the United States Court to forfeit the franchises.

OCEAN CITY, N. J.—At a meeting of the Cape May Board of Freeholders J. Fithian Tatem and Olin Bryan, lawyers representing an electric railway company, requested that a combination bridge be built over Great Egg Harbor Bay from Somers Point to Beesley's Point. The lawyers said they represented interests that desired to run an electric road from Philadelphia to Cape May. The Freeholders favored the suggestion, adopting a resolution and appointing A. B. Smith, J. P. Fox and David Rodan a committee to further the project.

INDIANAPOLIS, IND.—W. T. Durbin, chairman of the board of trustees, representing stock and bondholders of the Indianapolis and Cincinnati Traction Company, has submitted to the court a plan of reorganizing the company. Charles L. Henry, president of the company, also the receiver for the property, has approved the plan, and April 10, 1910, is the date set for the reorganization. If the court approves the plan the work of constructing an extension of the line from Connersville to Hamilton, Ohio, will be commenced at once.

SILVER LAKE, IND.—The people of Lake and Clay townships are anxious to subscribe to a fund in aid of the construction of the Wabash and Northern Interurban Company's road through Lake and Clay townships. A proposition to vote a subsidy tax in those townships was voted down, and the promoters proceeded to survey another route. J. A. Barry, promoter of the line, says the company has let a contract for the grading, furnishing, ties, rails, cars, etc. He says that it is the purpose to have cars running by July 4, 1910. S.

CUMBERLAND, MD.—Henry L. Doherty & Co., of New York, have purchased the controlling interest in the Cumberland and Western Electric Company, running fifty miles through the Maryland mining region, from Calton L. Bretz, general manager of the Cumberland & Pennsylvania Railroad, who purchased it in his own right four years ago for about $200,000. The line has power houses at Clarysville and Reynolds and fourteen cars, and since Bretz controlled the line $150,000 has been spent in improvements. The purchasers operate trolley and electric light systems in various sections of the country.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

ARABI, GA.—It is stated that a telephone system will be established in this city. The mayor can give information. B.

WADENA, MINN.—William Perrin is trying to secure the construction of a farmers' telephone line due north from Wadena. C.

SAN FRANCISCO, CAL.—All the wires of the Pacific States Telephone Company in Alameda will be placed in underground conduits.

VERGAS, MINN.—James Nesbitt, A. G. Schwarzrock and others have incorporated the Vergas Telephone Company, with a capital of $10,000. C.

CORDELE, GA.—Another farmers' telephone line is to be constructed, to have connection at Cordele with the Southern Bell Telephone and Telegraph Company. Orders for material have been placed. B.

CARY, GA.—B. F. Abney, of Cary, is said to be interested in the construction of a ten-mile telephone system from Cary to Danville, Ga. B.

PLAZA, N. D.—The Queen City Telephone Company is constructing a line to Powers Lake on the north and the Missouri River on the south. C.

CAMP CROOK, S. D.—The Belle Fourche Company will install a local telephone exchange and wire the town. The line to Buffalo will be completed. C.

ATKINSON, N. C.—The Pender Telephone Company has been organized here, with a maximum of $10,000 capital, by E. E. Murphy and associates. L.

PHILLIPSBURG, TEXAS—The Phillipsburg Telephone Company has been incorporated with a capital of $1,000, by John Stern, C. F. Meyer and C. C. Thiel.

DILLON, MONT.—The Montana Independent Telephone Company expects to have a new exchange and telephone system in operation here in a short time.

MART, TEX.—The Limestone Telephone Company has been incorporated with a capital of $4,500, The incorporators are Richard Blackwood, E. F. King and T. B. Moore.

BUTTE, MONT.—The Montana Independent Telephone Company has been incorporated by H. A. Fallwey, Chas. J. Kelly, Cornelius F. Kelly and others. Capital, $1,000,000.

FAYETTEVILLE, TEXAS—A new telephone line is under construction from here to Ellinger, Texas, and same is contracted by the Fayette County Telephone Company of La Grange.

PETALUMA, CAL.—The Petaluma Rural Telephone Company has been incorporated here, with a capital stock of $50,000, by D. M. Winans, T. G. King, G. B. Robinson, S. L. Stice, E. P. Long and Frank Whitlatch.

BEAUMONT, TEX.—The Cleveland Telephone Company, of Cleveland, Tex., is running a new telephone line from here to Cleveland. The line will include Silsbee, Kountze, Fuqua, Bragg, Milvid, and a number of other points.

ALBANY, N. Y.—The Allegany Telephone Company, organized to operate in Allegany County, was also incorporated, with a capital of $10,000. The directors are: Robert E. Lang, George J. Fisk and John B. White, of Belfast.

MANISTEE, MICH—.The board of supervisors has granted permission to the Manistee County Electric Company to build several dams on Manistee River. The first dam, at High Bridge, will be started at once and is to cost $2,000,000.

INDIANAPOLIS, IND.—Articles of incorporation have been filed in the office of the secretary of state of the Tennyson Mutual Telephone Company, Tennyson, Ind. Capital stock, $2,000. President, E. L. Simpson; secretary, Lawrence Bender; treasurer, T. A. Rhoads.

SANDY SPRINGS, S. C.—The farmers of this section have organized the Sandy Springs Telephone Company, which will begin business with about 100 subscribers. The lines will probably be connected with the Southern Bell Telephone Company long-distance system also. L.

DILLON, MONT.—G. A. Mellinger, constructing engineer for the Independent Telephone Company, is planning the company's new system. C. B. Vaughn, who resigned his position as local manager for the Bell Telephone Company, has accepted the position of local manager for the Independent Company. C.

FLINT, MICH.—The Michigan State Telephone Company is building a new central exchange, with capacity for a city of 100,000. The plant with equipment will cost $100,000. Private exchanges are also to be installed for the Buick Motor Company and the Weston-Mott. The Buick exchange will be the largest private installation in the state.

LAWRENCE, KAN.—The Bell Telephone Company has filed a statement with the City Council, formally refusing to accept a franchise recently granted it. The ordinance required the company to pay the City of Lawrence two per cent of the gross receipts; to bring the books to Lawrence for examination, and to maintain a forty-volt circuit; all of which the company refused to do.

WESTVILLE, IND.—The residents of this city and subscribers of the two telephone companies operating here, held a meeting November 12, and served notice on the two companies that unless they consolidate and do away with the dual service within a month they will discontinue the use of the service. The people insist on a single service and that the consolidated company must install some modern equipment and extend the lines throughout Laporte County. S.

GAINESVILLE, GA.—A telephone line has been built to Oconee Mills. A farmers' line has also been built along the Carnesville road. With this addition there are now twenty-three farmers' telephone lines connected with the Gainesville exchange of the Southern Bell Telephone and Telegraph Company, and it is stated that five other lines will be built into Gainesville within thirty days. There are 314 subscribers on the rural lines already in operation. B.

BURLINGTON, VT.—The Heath Telephone Company has been incorporated. The Heath Telephone Company, with a capital stock of $7,000, has filed with the secretary of state papers enabling it to do business in Vermont. It is incorporated under the laws of Massachusetts and is to begin work in Windham County in competition with the New England Telephone and Telegraph Company. Charles S. Goodrow, of Readsboro, is the Vermont representative of the corporation.

ELECTRICAL SECURITIES.

The past week has been marked by a number of sudden drops in nearly all stocks. On the whole the values have been held up and rallied from time to time by large stockholders and "inside" men, so that considering the little panics of the smaller stockholders there has been very little decrease in the value of securities.

The Aurora, Elgin & Chicago October gross earnings gained $18,000. The November gain has been greater.

Authorization has been given by the New York Public Service Commission, Second District, to the Northern Westchester Lighting Company, of Ossining, to issue $125,000 in bonds to pay for improvements.

The American Telephone and Telegraph Company advises holders of treasurer's receipts that the company will be prepared to issue on and after December 1 its engraved certificates of stock in exchange for treasurer's receipts upon surrender of such receipts at the office of the assistant treasurer, 15 Dey Street, New York city.

The Poughkeepsie Light, Heat and Power Company, of Poughkeepsie, N. Y., has sold to James A. Hutchinson, bond dealer, $100,000 first consolidated fives, due November, 1921, this amount being the balance of the authorized amount under this mortgage. The bonds are a first lien on the entire plant, subject to $75,000 fives, due 1914.

Interborough Rapid Transit October gross increased about $7,000 a day, and for the first half of this month about $8,300 per day, so that for the first four-and-one-half months of the current fiscal year gross gained close of $1,200,000, or seventy-five per cent, of the total gain of $1,616,093 for the entire fiscal year ended June 30, last.

The Boston & Worcester Street Railway has petitioned the Massachusetts Railroad Commission for permission to increase its stock from $2,025,000 to not exceeding $2,525,000, to be offered stockholders at $100 per share, the proceeds to be used for extension, improvement and additional rolling stock. The company also petitions for right to issue twenty-year four-and-one-half per cent bonds not exceeding $500,000.

The Atlantic '& Pacific Telephone and Telegraph Company, a New Jersey corporation, has increased its capital stock from $25,000 to $250,000. The company belongs to the Bell Telephone system.

John I. Beggs, Edwin M. Bulkley, Adolphus Busch, James Campbell, F. S. Smithers, George R. Sheldon and Charles W. Wetmore, voting trustees of common stock, trust certificates issued under the United Railway Company of St. Louis, voting trust agreement of November 1, give notice that the common stock trust certificates may now be exchanged for the shares of the common capital stock of the United Railways Company, of St. Louis.

DIVIDENDS.

General Electric Company; quarterly dividend of two per cent, payable January 15 to stockholders of record December 4.

Kansas City Railway and Light Company; quarterly dividend of one-and-one-fourth per cent on the preferred stock, payable December 1 to stockholders of record November 19.

Rochester Railway and Light Company; preferred dividend of one-and-one-fourth per cent, payable December 1.

St. Joseph Railway, Light and Power Company; preferred dividend of one-and-one-fourth per cent, payable December 31.

Washington Railway and Electric Company; semi-annual dividend of two-and-one-half per cent on preferred stock, and an initial semi-annual dividend of one per cent on common stock.

NEW YORK.

	Nov. 22.	Nov. 15.
Allis-Chalmers common	15½	15
Allis-Chalmers preferred	55	53½
Amalgamated Copper	93⅜	90⅞
American Tel. & Cable	*80	*80
American Tel. & Tel.	143⅞	141¾
Brooklyn Rapid Transit	78¼	75¾
General Electric	163	162
Interborough-Metropolitan common	22⅜	22⅞
Interborough-Metropolitan preferred	55½	54¾
Kings County Electric	129	129
Mackay Companies (Postal Telegraph and Cables) common	93	92¼
Mackay Companies (Postal Telegraph and Cables) preferred	76	75⅞
Manhattan Elevated	140	140
Metropolitan Street Railway	20	25
New York & New Jersey Telephone	123½	123½
U. S. Steel common	89¾	90⅜
U. S. Steel preferred	125¾	126
Western Union	79½	79
Westinghouse common	85¾	85
Westinghouse preferred	135	135

*Last price quoted.

BOSTON.

	Nov. 22.	Nov. 15.
American Tel. & Tel.	143⅞	141⅜
Edison Elec. Illuminating	250	.....
General Electric	163	162
Massachusetts Electric common	16	15¾
Massachusetts Electric preferred	80	.....
New England Telephone	134	134
Western Tel. & Tel. common	12¼	11¼
Western Tel. & Tel. preferred	.....	88

PHILADELPHIA.

	Nov. 22.	Nov. 15.
American Railways	45	45¼
Electric Company of America	12½	12⅛
Electric Storage Battery common	58½	59
Electric Storage Battery preferred	58½	59
Philadelphia Electric	12¾	13⅛
Philadelphia Rapid Transit	26¼	26¾
Philadelphia Traction	89	89
Union Traction	52½	52¾

CHICAGO.

	Nov. 22.	Nov. 15.
Chicago Railways, Series 1	98	104
Chicago Railways, Series 2	33	33¼
Chicago Subway	6	6¾
Chicago Telephone	136	136
Commonwealth Edison	119	119
Metropolitan Elevated common	16	16½
Metropolitan Elevated preferred	52	52
National Carbon common	96½	96½
National Carbon preferred	123	118½

PERSONAL MENTION.

H. BISHOP has been appointed manager of the San Benito Light and Power Company, of Hollister, Cal., taking the place of J. L. Galbraith.

P. G. JONES has established Pacific Coast offices for the American Electric Fuse Company, of Muskegon, Mich., at 121 Second Street, San Francisco.

R. A. McLAUGHLIN, formerly general manager of the McKinley properties in Galesburg, has been made general manager of new business for all of the McKinley companies.

WILLIAM S. TAUSSIG, secretary of the Chicago Electric Club and a well-known manufacturer's representative, will move on December 1 to 627 West Jackson Boulevard, Chicago.

PROFESSOR L. A. HERDT, head of the department of electrical engineering at McGill University, has been appointed honorary secretary for Canada of the American Institute of Electrical Engineers.

W. H. EVANS recently resigned as superintendent of the Central California Traction Company, in Stockton, Cal., to enter the electrical department of the Southern Pacific Company at Portland, Ore.

A. B. LEBENHAUM and E. B. PIKE, who recently sold their interest in the Butte Engineering and Electric Company, of San Francisco, are now handling electrical novelties, lamps and heating appliances.

HORACE L. BRUNN, of Cambridge, Mass., who has been for a number of years prominent in electrical work, has left for the Philippine Islands, where, as chief engineer of the Boston Standard Electrical Company, he is to take charge of important electrical work.

JOHN M. KLEIN, a member of the firm of Mathias Klein & Sons, Chicago, the well-known makers of Klein's construction tools, has just returned from a six weeks' trip to the Pacific Coast. Mr. Klein called on the company's principal customers and the leading dealers, and found them all very optimistic as to the future. Mr. Klein stated that construction work was quite active on the coast and considered the prospect for the coming season in the electrical lines very promising. The firm's business has shown a gratifying increase during the past few months. Customers who have been on the company's books year after year are using more Klein material than ever, and new users are being added constantly.

W. A. LAYMAN, vice-president and general manager of the Wagner Electric and Manufacturing Company, St. Louis, Mo., was a New York visitor this week, conferring with the company's Eastern representative, E. W. Goldschmidt, and meeting many eastern customers.

W. E. SHARP, vice-president of the Lincoln Traction Company, of Lincoln, Neb., was elected president of the corporation at the yearly meeting held on November 16. Mr. Sharp was president of the Citizens' Company at the time when it was merged with the Traction Company.

F. R. NEWMAN, superintendent of the York Railways Company, has resigned his position and will shortly be connected with the Southern Cambria Electric Railway Company, of Johnstown, as superintendent. Mr. Newman has been identified with the York Railways Company for the past four-and-one-half years.

HON. JACOB CANTOR, of New York, is the president of the Electrical Automatic Railroad Safety Signal Company, manufacturing the Lacroix safety signal device, invented by F. Lacroix, of Texas. The system is for the purpose of preventing railroad accidents, and includes among other things a telephone equipment in the engineer's cab.

JOHN A. JONES, of Lewiston, Me., has been appointed railroad commissioner of the state of Maine. Mr. Jones is a graduate of Bates College, and has been engaged in railroad construction for a number of years. He has surveyed and built over 400 miles of electric roads, among which are those between Portland and Lewiston, Camden and Belfast, and Rumford Falls and Bethel.

RALPH W. POPE, secretary of the American Institute of Electrical Engineers, has been making another extended trip on behalf of the local sections. Mr. Pope was authorized by the board of directors at its meeting on November 12 to visit the Institute sections and branches in the Central West. He left New York on November 14, coming direct to Urbana, Ill., where he addressed the Urbana Section at the University of Illinois. On November 16 Mr. Pope visited Chicago with Dr. C. P. Steinmetz, upon which occasion Dr. Steinmetz addressed the Chicago Section members in Fullerton Hall of the Art Institute. Mr. Pope's itinerary takes in also Madison, Wis., Minneapolis, Minn., St. Paul, Minn., Ames, Iowa, and Fort Wayne, Ind.

FRANK L. PERRY, one of the well-known electrical men of Chicago, and for many years business manager of the *Western Electrician*, is carrying out some very interesting and important work at his research laboratory in Chicago. Mr. Perry is specializing to a great extent upon a study of wave phenomena and the utilization of apparatus designed to operate through manifestations of oscillatory motion. It will be remembered that during the early experiments of the Wright Brothers, Mr. Perry made a close study of the aeroplane and elucidated then the suggestion of its use as a wireless telegraph station. During the past twelve months Mr. Perry has enlarged upon this idea, and has a very successful model which has been used to demonstrate his ideas in a number of lectures before engineering, scientific and commercial organizations. In a recent Sunday issue of the Chicago *Tribune* a double-page illustrated story described some of the work Mr. Perry is doing in this direction.

OBITUARY.

FREDERICK FAIRFIELD, manager of the Western Union Telegraph Company's office in New Haven, Conn., died suddenly of heart trouble last week. He was a veteran operator, having been in the employ of the company since boyhood, and his many years of service had made him widely known. During the Civil War, Mr. Fairchild was on duty as an operator in New Haven.

JAMES ELLIOTT DEFEBAUGH, editor of the *American Lumberman* and prominent in business and manufacturing circles in Illinois, died at Columbus Hospital, Chicago, on Sunday, November 21. Mr. Defebaugh had always been a ceaseless worker in the lumber field, and for months during the last session of Congress was engaged in the tariff fight on behalf of the lumber interests. He was an active member of the Chicago Association of Commerce and the Illinois Manufacturers' Association. Overwork, from attending to his many interests, contributed largely to Mr. Defebaugh's death. He is survived by a widow and one son.

NEW PUBLICATIONS.

MUNICIPAL SCHOOL OF TECHNOLOGY, MANCHESTER, ENG.—This polytechnic school has recently issued Vol. 1, Part 3 of its journal, containing "a record of the work of the school." These interesting publications contain abstracts of papers read by members of the staff and by students of the school, before various scientific and technologic bodies, of contributions to the technical press, and the like. The contents are departmentalized into sections on

mechanical engineering, physics, electrical engineering and chemistry. The editing seems to have been very well done and the general make-up is surprisingly good. The idea might advantageously be copied by other schools and colleges.

THE TECHNOLOGY REVIEW—The October number of this quarterly publication of the Massachusetts Institute of Technology has just been issued and is replete with news of the Institute and of its alumni. Among notable items is an account of the development of the Technology Club in New York. The announcement of a new course in electrochemistry at the Institute is also of interest. A sign of national prosperity is evinced by the statement that the demand for Technology graduates is much in excess of the supply.

BULLETIN OF THE BUREAU OF LABOR—The May, 1909, number of this publication (issued by the United States Department of Commerce and Labor, Washington, D. C.), which has just come to hand, is concerned mainly with a long article by Frederick L. Hoffman on "Mortality from Consumption in Occupations Exposing to Municipal and General Organic Dust." Among other contents are the usual digests of reports of state bureaus of labor statistics, a digest of recent foreign statistical publications, court decisions affecting labor, etc.

INDUSTRIAL ITEMS.

THE MINNEAPOLIS STEEL AND MACHINERY COMPANY is furnishing one of its Muenzel producer-gas engines and gas-producer plants for the electric-light plant at Milbank, S. D., which is owned by Oscar Claussen, consulting engineer, St. Paul, Minn.

JOHN A. ROEBLING'S SONS COMPANY, of Trenton, N. J., has received a large order of wire from the Metropolitan Electric Company, of West Reading, Pa. Lines are to be installed by the Reading company to substations at Ringing Rocks, Mount Penn and Mohnton.

THE H. T. PAISTE COMPANY, Philadelphia, Pa., has recently issued the November number of its monthly publication, entitled "Paistery." In addition to the usual interesting editorial pages, this issue contains interesting descriptions of new sockets, outlets and rosettes.

J. G. WHITE & COMPANY, INCORPORATED, engineers and constructors, with offices at 43-49 Exchange Place, New York city, announce the opening of a branch office in the First National Bank Building, Chicago, Ill. Charles T. Mordock will be in charge of this office as manager. The company also has a branch office in the Alaska Commercial Building, San Francisco, Cal.

THE FORT WAYNE ELECTRIC COMPANY, Fort Wayne, Ind., has a contract for supplying electric machinery to the Corry-Deavitt-Frost Company. The power plant will be auxiliary to the one already in operation at that point, and will contain two generators, one capable of producing 450 kilowatts, and the other 187 kilowatts. A large modern switchboard will also be installed at the plant.

THE SHULTZ BELTING COMPANY, St. Louis, maker of Shultz sable belting, reports that it is taxed to its capacity to meet the demand for its product. At the present time the company is shipping belting to Italy, South Africa, Russia and other foreign countries. The company has just received an order from Sweden for 16,500 feet of belting. It has also equipped the electric railway and lighting plant in Natchez, Miss., with thirty-five-inch three-ply belting.

THE SIMPLEX ELECTRIC HEATING COMPANY, Cambridge, Mass., has recently distributed a series of six circulars describing nickel and silver plated electric devices. These circulars are devoted to the following Simplex products: Heating pads, electric flatirons, electric toasters, electric chafing dishes, electric coffee percolators, electric ranges and electric flatiron conductors. These publications are opportune at this time in facilitating the selection of Christmas gifts.

THE NATIONAL METAL MOLDING-COMPANY, Pittsburg, Pa., is distributing a booklet devoted to data in relation to the practical features of "Sherarduct," the rustproof, non-corrosive conduit. The rustproof and non-corrosive features of this conduit are secured by the pipe being subjected to the sherardizing process, in which zinc dust is anchored and impregnated uniformly into the metal over all parts, which cannot be separated from the pipe either mechanically or chemically.

THE KELLOGG SWITCHBOARD AND SUPPLY COMPANY, Chicago, Ill., reports the closing of a contract for a common battery, multiple switchboard and telephones for the Crawford Telephone Company, Crawford, Neb., recently secured by L. R. Foote, its Nebraska representative. This board will be in the Kellogg company's latest type 3,000-line section, and while the present equipment is only for 300 common battery lines and twenty rural and toll lines, the telephone company expects to be operating many times this number of telephones within the coming year. The line construction in connection with this plant is far in advance of most towns of its size, and the major portion of the lines being distributed through cable. This company has looked far enough ahead to realize that the success of its undertaking depends in a very large measure upon the ease with which it can come into contact with neighboring towns and distant cities. Toll lines in service and under construction connect or will connect Crawford with all of the principal cities of the middle West.

THE BEARDSLEE CHANDELIER MANUFACTURING COMPANY, Chicago, Ill., is distributing an attractive booklet entitled "Holiday Suggestions" and devoted to electric and gas portable lamps. Among the twenty-odd illustrations contained in this publication are some of the newest and latest designs in portable lamps. Each lamp is described and the necessary instructions and data are given for ordering the same. This booklet should prove valuable at this time in facilitating the selection of appropriate Christmas gifts in this line. Copies may be obtained on request to the company.

THE WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY is beginning work at its East Pittsburg shops on a very heavy order for railroad motors for the Long Island Railroad, which represent almost a million dollars. This calls for 260 motors of 200 horsepower each, which will be used to equip part of the cars on the Long Island system, and is in line with the enormous development work that the Pennsylvania Railroad Company is now doing in anticipation of the completion of the New York terminals and tunnels under the North and East Rivers.

THE ALLIS-CHALMERS COMPANY, of Milwaukee, Wis., is receiving numerous orders for transformers from some of the large electric companies on the Pacific Coast, including the Great Western Power Company, of San Francisco; the Pacific Gas and Electric Company, San Francisco; the Bear Lake Power Company, Montpelier, Idaho; Portland Railway, Light and Power Company, Portland, Ore.; the Sacramento Valley Power Company and the Los Angeles Gas and Electric Company. These transformers vary in size from 200 kilowatts to 1,500 kilowatts, and for the most part are of the oil-filled, water-cooled type. Numerous other orders have also been received.

THE AMERICAN CONDUIT AND MANUFACTURING COMPANY, of Pittsburg, Pa., has prepared a compact folder in which the merits of "Wireduct," the non-metallic flexible conduit made by the company, are pointed out. This conduit is made of an inner tube of canvas, over which is wound a fire-resisting fiber tape, which adheres to it firmly. Over the tape is placed an outer covering of non-inflammable and moisture-proof material. The conduit is said to remain permanently flexible, but does not collapse nor make any kinks. Upon request the company will be glad to supply detailed information and literature in relation to this product.

J. G. WHITE & COMPANY, INCORPORATED, engineers and contractors, 43 Exchange Place, New York city, have just been awarded the contract for the double tracking of the Albany Southern Railroad between Rensselaer and Kinderhook Lake, N. Y., as well as the straightening of curves and the rehabilitation of a large amount of the present track of that company. In addition to the operation of its third-rail electric road between Albany and Hudson, N. Y., the railroad company furnishes electric light to the following towns: Rensselaer, East Greenbush, East Schodack, Nassau, North Chatham, Niverville, Valatie, Kinderhook, Stuyvesant Falls, Stottville, and also owns and operates gas plants in Hudson and Rensselaer, N. Y.

THE FANCLEVE SPECIALTY COMPANY, Jamaica Plain, Mass., has recently distributed its December bulletin, devoted to fittings for metal moldings. This bulletin, which is to be used in connection with the catalogue issued in April, describes regular and angle pattern molding boxes for metal moldings intended for making junctions at the angle formed by the intersection of walls and ceilings, and cover the excessive cutting made necessary in passing an elliptical-shaped molding through the ceiling, partitions or floors. There are also described switch junction or receptacle boxes, junction boxes, or mounts for surface fittings and outlet plates for metal moldings. In connection with this descriptive matter this bulletin contains specifications, diagrams and data which should prove useful to those interested.

DATES AHEAD.

International Independent Telephone Association. Annual convention, Chicago, December 7, 8 and 9.

Chicago Electrical Show, Coliseum, Chicago, January 15 to 29, 1910.

Toledo Electrical Show, Coliseum, Toledo, Ohio, January 31-February 5, 1910.

San Francisco Electrical Exposition, January 29-February 5, 1910.

Philadelphia Electrical Exposition, Philadelphia, Pa., February 14-26, 1910.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) November 16, 1909.

939,969. INCANDESCENT ELECTRIC LIGHT. James T. Bigger, Owensboro, Ky. Filed April 17, 1908. An insulating plug mounted in the cap has, at one face, spaced dovetailed tongues embraced by and clamped to U-shaped contacts, the latter electrically connected to and controlling filaments of different lengths. A push-piece is slidably mounted in the plug and contacts with either selected one of the U-shaped contacts.

939,973. BLOCK SIGNALING SYSTEM. Frederick F. Brush, Detroit, Mich. Filed August 26, 1907. The semaphores are electrically actuated.

939,984. ELECTRIC RAILWAY SIGNALING APPARATUS. William J. Cook, Denver, Colo. Filed July 13, 1908. The locking device for a movable signal is electromagnetically released.

939,995. CURRENT COLLECTOR. George R. Forster, Fithian, Ill. Filed June 15, 1908. Two trolley wheels, arranged tandemwise, are each provided with an interior lubricating device and a series of anti-friction rollers for their supporting axial pins.

939,999. APPARATUS FOR RECORDING DEVIATIONS IN THE COURSE OF A VESSEL. Joseph Fraser and Charles Jumeaux, Auckland, New Zealand, assignors of one-third to Samuel Edgar Fraser, Waihi, New Zealand. Filed October 5, 1907. The magnetic needle is provided with an autographic recording device for deviations.

940,008. COMBINED PRIMARY AND SECONDARY BATTERY SYSTEM. Julius H. Gugler, Milwaukee, Wis. Filed June 17, 1909. Describes a system of electrical distribution, including primary and secondary batteries, switches, etc.

940,012. CONNECTOR. Theodore A. Hammond, Passaic, N. J. Filed March 18, 1908. A terminal connector for connecting an electrical conductor to a post is provided with a sleeve for engaging the conductor and has gripping members at its ends.

940,021. LUMINOUS ELECTRIC HEATER. William F. Howard, West Ealing, and Alban B. Cousins, Abingdon-on-Thames, England. Filed February 1, 1909. Each heating element consists of an exhausted bulb with an electric filament of zigzag or other shape extending longitudinally through it and connected to massive external terminals at the ends.

940,028. THIRD-RAIL ELECTRIC-RAILWAY SYSTEM. Charles Kozesnik, New York, N. Y. Filed April 25, 1908. Describes a form of surface-contact system.

940,043. SECONDARY BATTERY. William Morrison, Chicago, Ill. Filed June 8, 1903. Has a horizontal grid with openings or pores containing metallic zinc (electrically reduced from zinc oxide), this forming the negative electrode. The electrolyte is composed of a suitable alkaline solution.

940,047. ATTACHMENTS FOR TELEPHONES. John W. Nilsson, Balfour, N. D. Filed January 19, 1909. Comprises an audible signaling device, a second transmitter, and means to connect operatively the signaling device to a receiver fork.

940,112. MOTOR-CONTROL SYSTEM. Ernst F. W. Alexanderson, Schenectady, N. Y., assignor to General Electric Company. Filed September 11, 1907. The method of operating a number of series motors mechanically connected to drive a common load, consists in connecting the motors to the line with each motor field in series with its armature, impressing independent voltages on the field terminals of the several motors, and simultaneously varying the amounts of these voltages.

940,140. TELEPHONE-CALL-RECORDING DEVICE. George R. Fawkes, Waterloo, Iowa. Filed November 19, 1908. Describes in detail a ratchet device for autographically recording telephone calls.

940,151. RESISTANCE UNIT. Harry E. Heath, Lynn, Mass., assignor to General Electric Company. Filed October 3, 1906. An electric-heating resistance comprises a sheet of flexible heat refractory insulating material rendered partially conductive by a deposit of metal on the inner fiber thereof.

940,164. MOTOR-CONTROLLING DEVICE. Charles D. Knight, Schenectady, N. Y., assignor to General Electric Company. Filed January 21, 1907. Means independent of the starting rheostat are provided for causing the motor speed to be automatically and gradually varied a predetermined amount when the controlling element of the rheostat reaches a certain position.

940,174. COMBINED SWITCH AND FUSE-PIPE. Frederick Mackintosh, Schenectady, N. Y., assignor to General Electric Company. Filed September 30, 1907. The adjacent ends of the two sections of the switch blade overlap and are separated by an insulation. Plug contacts are connected respectively to these ends and means are provided for rigidly clamping together these overlapping ends.

940,176. LIGHTNING-ARRESTER. Charles T. Mason, Sumter, S. C., assignor to the Sumter Telephone Manufacturing Company, Sumter, S. C. Filed May 1, 1908. Comprises a coil having abrupt turns or angles and a flat face or side, a grounding block arranged exteriorly of the coil and extending along the flat face or side thereof, and means for detachably clamping the block to the coil.

940,188. PROCESS OF MAKING INSULATING FABRICS. Charles F. Peterson, Schenectady, N. Y., assignor to General Electric Company. Filed March 27, 1906. The process of making sheet insulating material consists in shellacing overlapping fragments of mica to a continuous web of material, covering the mica with a second web of material and applying a second coating of shellac.

940,209. ATTACHMENT FOR MERCURY-LAMPS. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. Filed October 22, 1904. In combination with a vapor electric apparatus having a high initial resistance and a relatively low-running resistance, is a resistance unit in shunt with the lamp, having a negative temperature coefficient, and adapted normally to carry no appreciable current.

940,210. DYNAMO-ELECTRIC MACHINE. Charles P. Steinmetz, Schenectady, N. Y., assignor to General Electric Company. Filed March 20, 1909. Electrical connections are provided whereby motor current is delivered to and generator current taken from the armature, the generator current being taken through the commutator. Unwound commutating poles are located at the points of commutation of the generated current and magnetized by the resultant armature reaction.

940,211. ELECTRIC-RAILWAY SYSTEM. William M. Stephens, Philadelphia, Pa., assignor to Railways Surface Contact Supplies Company, Wilmington, Del. Filed January 4, 1907. Describes a form of surface-contact system.

940,220. LIGHTNING-ARRESTER. Eugene W. Vogel, Chicago, Ill. Filed May 5, 1906. A conducting coil of wire is secured at its ends to posts which are mounted on an insulating base. A ground conductor is also supported on the base and has its ends projecting into proximity to the posts.

940,241. SYSTEM OF CONTROL FOR ELECTRIC MOTORS. Arthur C. Eastwood, Cleveland, Ohio. Filed December 3, 1908. Comprises a reversing switch, a series of independently actuated speed-controlling switches, a master switch, a single conductor between the master switch and the reversing and speed-controlling switches, and means at the master switch for producing successive reversals of the direction of current flow through the control conductor for causing successive closure of the switches.

940,266. MAGNETIC SEPARATOR. Walter B. Moore, Walla Walla, Wash. Filed September 23, 1907. A wall is arranged to rotate with a rotating magnetic means in a tank, and is spaced therefrom so as to provide a passageway for the material to be separated, the upper portion of the wall being flared outwardly.

940,282. ELECTRIC SEPARATOR. George D. Rogers, Gloucester, Mass. Filed December 30, 1905. The mixture is subjected to the influence of the rotating electric field of a polyphase coil.

940,284. TELEPHONE. Frederick G. Sargent, Westford, Mass. Filed March 3, 1909. Describes a form of telephone receiver.

940,288. STORAGE BATTERY. Alfred O. Tate, Toronto, Ont., Can., assignor to Tate Electrolytic Company of America. Filed February 24, 1908. A unifunctional storage battery plate embraces a series of thin narrow conducting strips all connected together electrically at one end and separated from each other by porus insulating material, all such conducting strips being insulated at their lateral edges from the electrolyte.

940,311. COMBINATION SWITCH AND BLOW-OUT. William C. Hafemeister, Cleveland, Ohio, assignor to the Van Dorn Electric and Manufacturing Company, Cleveland, Ohio. Filed July 12, 1907. A bellows is provided to blow an air jet between the contacts, one of which is fixed and the other movable.

940,318. ELECTRIC MEASURING INSTRUMENT. Adrian H. Hoyt, Penacook, N. H. Filed October 18, 1907. Describes a combination of ammeter and voltmeter, with switch and circuit connections.

940,319. ELECTRIC MEASURING INSTRUMENT. Adrian H. Hoyt, Penacook, N. H. Filed January 20, 1908. Comprises a permanent horseshoe magnet, an armature frame surrounding a core and connected to a pointer, an armature winding, etc.

940,328. ELECTRIC SWITCH. Otto M. Knoblock, South Bend, Ind. Filed March 6, 1907. Describes a form of knife switch.

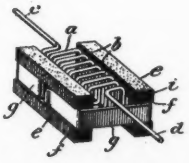
940,335. BINDING-POST. Henry E. Leppert, New Britain, Conn., assignor to the Hart Manufacturing Company, Hartford, Conn. Filed February 25, 1909. Comprises a stationary member with two opposing walls and two screw-threaded members, one free to revolve, etc.

940,359. TELEPHONE DETECTOR DEVICE. Theodore W. Ralph, North Augusta, Ont., Can. Filed November 16, 1908. Comprises a base, two tracks supported by the base and each provided with strips of current-conducting material separated by blocks of insulating material, a roller operating between the tracks, and an axle for the roller insulated therefrom and designed to operate over the top of the strips and blocks of the conducting and non-conducting material when the device is tilted.

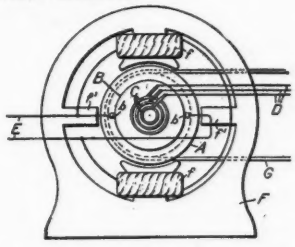
940,361. EGG-TESTER. William Rigling, Hamilton, Ohio. Filed September 2, 1909. Has an electric lamp contained in a bowl-shaped reflector over which is a shelf with egg-receiving perforations.

940,376. IGNITION SYSTEM FOR EXPLOSION-ENGINES. Paul R. Werner, Philadelphia, Pa. Filed October 5, 1908. Has primary and secondary circuits and a selector brush carried by a rotating shaft.

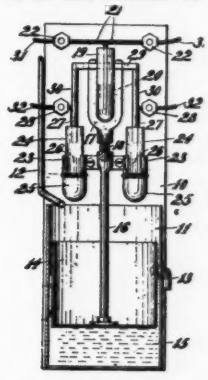
940,377. TYPE-CASTING AND COMPOSING MACHINE. William Ackerman, New York, N. Y., assignor to United States Graphotype Company, New York, N. Y. Filed December 28, 1905. A machine for registering upon a type-casting machine-controller the composition to be cast in the casting machine, comprises a keyboard having groups of keys representing a number of lay-outs or fonts or parts thereof, selective means for registering upon the casting-machine controller the several characters appearing in the several keyboard groups, and means whereby one at a time of these keyboard groups may be placed in operative connection with the controller registering means.



940,176.—LIGHTNING ARRESTER.



940,210.—DYNAMO-ELECTRIC MACHINE.



940,408.—DOUBLE-ACTING SWITCH.

940,392. ELECTRIC GENERATOR. Edward T. Kenney, Indianapolis, Ind., assignor to the Henricks Novelty Company, Indianapolis, Ind. Filed April 16, 1908. The rotor is laminated in a specified way.

940,393. BRUSH-HOLDER. Earle R. Knight, Norwood, Ohio, assignor to the Bullock Electric Manufacturing Company. Filed August 30, 1905. Parallel side plates are held a predetermined distance apart by a connecting plate having a flat portion forming a brush guide and an upper portion curved to receive a supporting stud.

940,397. BINDING-POST. Adam Lüngen, New York, N. Y., assignor to Edwards & Company. Filed January 16, 1909. Comprises a body having upwardly bent arms, a screw journaled in both of these arms and extending therebetween and having a head and a collar to prevent its longitudinal movement in either direction, and a traveling nut having a lower flat face guided against the body.

940,408. DOUBLE-ACTING SWITCH. Clarence J. Spellman, Wauwatosa, Wis., assignor of one-half to Charles W. Norris, Milwaukee, Wis. Filed December 7, 1908. Comprises a stationary mercury cup, a suitably operated member carrying a second mercury cup and a depending contact arm to dip within the first mercury cup, and a stationary contact to dip within the second mercury cup when the member is moved to withdraw the contact arm from contact with the mercury in the first mercury cup.

940,428. APPARATUS FOR NEUTRALIZING ELECTRICITY IN MOVING MATERIAL. William H. Chapman, Portland, Me., assignor to Chapman Electric Neutralizer Company, Portland, Me. Filed November 3, 1905. A comb conductor is located adjacent to the moving material and earth-connected, and an insulated conductor is located adjacent to the comb conductor and charged with electricity of the same polarity as that of the material to be treated.

940,429. METHOD OF NEUTRALIZING STATIC ELECTRICITY. William H. Chapman, Portland, Me., assignor to Chapman Electric Neutralizer Company, Portland, Me. Filed December 18, 1905. Consists in charging a conductor embodying fine radiating surfaces with electricity of high voltage and of a polarity opposite to that of the surface to be neutralized, interposing between the conductor and the surface to be neutralized a perforated screen of metal or other conducting material connected to earth and inserting a high resistance in the earth connection for causing an accumulation on the screen of the electricity radiated from the conductor.

940,430. PROCESS AND APPARATUS FOR NEUTRALIZING STATIC ELECTRICITY. William H. Chapman, Portland, Me., assignor to Chapman Electric Neutralizer Company, Portland, Me. Filed April 2, 1906. The apparatus for removing static electricity consists of a tube of conducting material connected to earth and having a longitudinal slot therein, a longitudinally disposed insulated conductor within the tube and means for supplying a high-voltage charge to the conductor.

940,431. MEANS FOR NEUTRALIZING STATIC ELECTRICITY. William H. Chapman, Portland, Me. Filed March 13, 1908. The means for neutralizing static electricity consist of an insulated cable connected with a source of high-voltage alternating electricity, a metal sleeve on the outside of the cable, a discharging conductor with a fine discharging point connected with the sleeve and a grounded conductor located adjacent to the discharging point.

940,444. VISUAL-SIGNAL APPARATUS. Rudolph Einbigler, New York, N. Y. Filed April 8, 1909. Comprises a nameplate mounted to swing, electromagnets for controlling the same, a station plate mounted to swing, an electromagnet for operating the same, and a controlling circuit for both sets of electromagnets to actuate both plates simultaneously from one station.

940,448. SPARK-PLUG FOR INTERNAL-COMBUSTION ENGINES. Maurice Eyquem, Paris, France. Filed April 28, 1908. Comprises a tubular electrode, a cock mounted on the latter and opening to the exterior, and a short-circuiting rod arrange on the plug of the cock and keyed so as to come in contact with the metal body of the spark-plug when the cock is open.

940,483. ELECTRIC CHIME. James E. Scovill, Chicago, Ill. Filed January 8, 1909. Comprises a frame with chime bells mounted therein, a chime-ringing device, a motor, a train of gearing for actuating the chime-ringing device, a motor circuit, a switch in the same, a relay provided with an armature adapted when energied to close the switch, and clock-controlled relay-energizing means.

940,487. ELECTROMAGNETIC TRACTION SYSTEM. Gardner L. Stanbro and Awrea D. Wagner, Norfolk, Va. Filed June 7, 1906. Describes a form of surface-contact system.

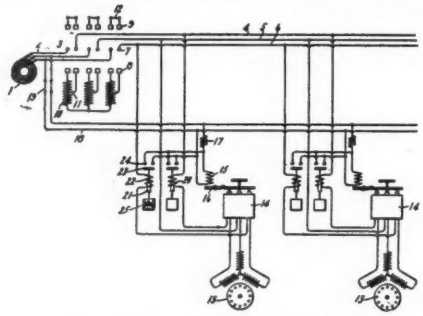
940,492. ARRANGEMENT FOR REGULATION OF SPEED OF COMPENSATED SINGLE-PHASE MOTORS. Engelbert Arnold, Karlsruhe, Germany, and Jens L. La Cour, Vesteras, Sweden. Filed November 23, 1908. A compensated alternating-current motor includes a main stator winding, a rotor winding provided with a commutator, brushes bearing on the commutator arranged to form with the rotor winding exciting and compensating circuits, an auxiliary stator winding along the magnetic axis of the exciting circuit, and means to shift the brushes toward and from each other without changing the direction of the axis of the compensation circuit.

940,495. ELECTRIC PROCESS FOR MAKING PICTURES. Braxton D. Avis, Jr., Wallace, W. Va. Filed June 23, 1908. The method consists in preparing a conducting surface, coating the same with a film, the solubility of which is affected by light, exposing the film for the purpose of rendering different portions thereof insoluble in various degrees so as to vary electrical resistance of different portions of the film, and depositing a metal electrolytically upon the conducting surface through the film.

940,511. MOTOR-VEHICLE. Frank E. Case, Schenectady, N. Y., assignor to General Electric Company. Filed October 10, 1906. A number of current collectors are arranged normally in engagement with the supply conductor, several motors are provided, and motor-controlling switches connect these motors in series to one collector at starting and independently to different collectors for running.

940,526. ELECTRICAL RECEPTACLE. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Filed May 6, 1909. A screw shell for an electrical receptacle has a base cut away to form securing flanges, portions of the base being rolled over on the flanges to reinforce the same.

940,550. APPARATUS FOR STARTING ELECTRIC MOTORS. Sidney B. Paine, Newton, Mass., assignor to General Electric Company. Filed May 28, 1909. A system of distribution comprises a source of voltage, a number of conductors, a starting device connected between the source and the conductors for simultaneously energizing the conductors alternately with a portion of the voltage from the source and with full voltage from the source, a number of motors connected in parallel to the conductor, switches connected in series between the motors and the conductors, overload tripping devices for the switches, under-voltage electromagnetic tripping devices for the switches and conductors connecting the tripping devices to the source independently from the starting device.



940,550.—APPARATUS FOR STARTING ELECTRIC MOTORS.

940,555. SUSPENSION DEVICE FOR TELEPHONE AND TELEGRAPH CABLES AND OTHER ELECTRICAL CONDUCTORS. Emery C. Read, Franklin, Pa. Filed November 25, 1908. Describes a form of clip.

940,561. TAPPING-FURNACE. George O. Seward, Holcombs Rock, Va., assignor to Electro Metallurgical Company. Filed May 3, 1904. The process of operating an electric tapping furnace consists in closing the tap hole by means including a conductive material, and opening the tap hole by the heat from an electric current arcing to and carried through the conductive material.

940,574. TROLLEY-HARP. James T. Archer, Champaign, Ill., assignor of one-half to Francis M. Foltz, Urbana, Ill. Filed November 18, 1908. A plunger is slidably mounted in the housing.

940,610. GAS LIGHTING AND EXTINGUISHING APPARATUS. Victor C. J. Nightingall, Melbourne, Victoria, Australia, assignor to the Nightingall Gas Control Company, Limited, Melbourne, Australia. Filed June 8, 1909. Electrically operated means are connected at certain segments of a number of revolving segmental switches (operating simultaneously with variation of gas pressure) for supplying gas to certain burners, etc.

940,616. AUTOMATIC CUT-OFF FOR WEIGH-SCALES. Robert W. Romig, Pittsburg, Pa., assignor to the Fairbanks Company, New York, N. Y. Filed July 16, 1907. The power cylinder has an electromagnetically operated valve.

940,632. DYNAMO-ELECTRIC MACHINE. Bernard A. Behrend, Norwood, Ohio, assignor to Allis-Chalmers Company and the Bullock Electric Manufacturing Company. Filed November 27, 1905. Includes a stationary armature comprising a core and supporting frame, a distributed armature winding comprising coils having end-turns extending beyond the core, a supporting ring for the end-turns, and means binding the end-turns to the supporting ring.

940,635. ELECTRODE ELEMENT FOR STORAGE BATTERIES. Thomas A. Edison, Llewellyn Park, Orange, N. J., assignor to Edison Storage Battery Company, West Orange, N. J. Original application filed November 2, 1905. Divided and this application filed February 6, 1908. The element comprises a perforated tubular inclosing pocket composed of a strip of steel, non-deformable under normal working condition, containing a highly compressed mass of active material, and formed with a spirally arranged joint.

940,645. SWITCH. Lembert H. Moulthrop, Bridgeport, Conn., assignor to the Perkins Electric Switch Manufacturing Company, Bridgeport, Conn. Filed September 12, 1908. Describes a form of push-button switch.

940,647. AUTOMATIC MAGNETIC CIRCUIT-BREAKER. William M. Scott, Philadelphia, Pa., assignor to the Cutter Electrical and Manufacturing Company. Filed January 19, 1907. An electrical switch comprises a movable contact member, a cam member for actuating the same, a member engaging the cam member to actuate the same by cam action, an actuator, and means for locking the actuator to the said member.

940,649. SHADE FOR ELECTRIC LAMPS. Nellie C. Bebin, London, England, assignor to Captain C. Wiener, Philadelphia, Pa. Filed March 12, 1906. An ornamental lamp-shade consists of a mesh beadwork cover for the globe.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 22, 1909:

486,457. INCANDESCENT ELECTRIC LAMP. Gustav A. Frei, Springfield, Mass.

486,488. ELECTRIC ARC LAMP. William O. Meissner, Chicago, Ill.

486,498. LIGHTNING ARRESTER. Harry G. Osburn, Chicago, Ill.

486,506. ELECTRIC SWITCHBOARD. Charles E. Scribner, Chicago, Ill.

486,507. TEST SYSTEM FOR MULTIPLE SWITCHBOARDS. Charles E. Scribner, Chicago, Ill.

486,524. DYNAMO-ELECTRIC MACHINE. George Baehr, Brooklyn, N. Y.

486,563. ILLUMINATED TIMEPIECE. Benjamin Haas, Jr., and Gustave Trouve, Paris, France.

486,569. ELECTRIC SIGNALING DEVICE. James J. Ross, Detroit, Mich.

486,575. PROCESS OF ELECTRICALLY REDUCING REFRACTORY COMPOUNDS. Thomas L. Willson, Leaksville, N. C.

486,612. ELECTRIC RELEASING DEVICE. William R. Hewitt, San Francisco, Cal.

486,624. ELECTRICAL METHOD OF, AND APPARATUS FOR, FORMING TUBES. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

486,625. ELECTRIC METAL-HEATING APPARATUS. George D. Burton, Boston, Mass.

486,626. ELECTRIC FORGING APPARATUS. George D. Burton, Boston, and Edwin E. Angell, Somerville, Mass.

486,627. ELECTRIC FORGE. George D. Burton and Edwin E. Angell, Somerville, Mass.

486,643. CURRENT DIRECTOR. James F. McElroy, Albany, N. Y.

486,644. CURRENT REGULATOR. James F. McElroy, Albany, N. Y.

486,656. CABON-BRUSH HOLDER FOR DYNAMO-ELECTRIC MACHINES AND MOTORS. James J. Wood, Fort Wayne, Ind.

486,689. ELECTRICAL MEASURING INSTRUMENT. Edward Weston, Newark, N. J.

486,715. ELECTRIC DEVICE FOR VIBRATING TABLES. William L. Imlay, Camden, N. J.

486,729. ELECTRIC LAMP SHADE. Charles J. Miller, Philadelphia, Pa.

486,757. ELECTRIC ARC LAMP. James Brockie, London, England.

486,807. ELECTRICAL HOSE SIGNALING APPARATUS. Willian Fowler, Colorado Springs, Colo.

486,820. ELECTRICAL ANNUNCIATOR. Franklin S. Carter, Burlington, N. J.

486,838. ELECTRIC CLOCK. Martin V. B. Ethridge, Everett, Mass.